PHILOSOPHICAL TRANSACTIONS:

GIVING SOME

ACCOMPT

OF THE PRESENT

Undertakings, Studies, and Labours

OF THE

INGENIOUS

IN MANY

CONSIDERABLE PARTS

OF THE

WORLD.

SMITHSONIAN

Vol I.

For *Anno* 1665, and 1666.

In the *SAVOY*,

Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, and *James Allestry* in *Duck-Lane*, Printers to the *Royal Society*.

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TO THE
Royal Society.

I will not become me, to adde any Attributes to a Title, which has a Fulneſs of Luſtre from his Majeſties *Denomination.*

In theſe Rude Collections, which are onely the Gleanings of my private *diverſions in broken hours, it may appear, that many Minds and Hands are in many places induſtriouſly employed, under Your Countenance and by Your Example, in the purſuit of thoſe Excellent Ends, which belong to Your Heroical Undertakings.*

Some of theſe are but the Intimations of large Compilements. And ſome Eminent Members of Your Society, *have obliged the Learned World with Incomparable* Volumes, *which are not herein mention'd, becauſe they were finiſht, and in great Reputation abroad, before I entred upon this Taske. And no ſmall Number are at preſent engaged for thoſe weighty Productions,*

which

which require both *Time and Aſſiſtance, for their due Maturity. So that no man can from theſe Glimpſes of Light take any juſt Meaſure of Your Performances, or of Your Proſecutions; but every man may perhaps receive ſome benefit from theſe Parcels, which I gueſſed to be ſomewhat conformable to Your Deſign.*

This is my Solicitude, That, as I ought not to be unfaithful to thoſe Counſels you have committed to my Truſt, ſo alſo that I may not altogether waſte any minutes of the leaſure you afford me. And thus have I made the beſt uſe of ſome of them, that I could deviſe; To ſpread abroad Encouragements, Inquiries, Directions, and Patterns, that may animate, and draw on Univerſal Aſsiſtances.

The Great God *proſper You in the Noble Engagement of Diſperſing the true Luſtre of his Glorious Works, and the Happy Inventions of obliging Men all over the World, to the General Benefit of Mankind: So wiſhes with real Affections,*

Your humble and obedient Servant

HENRY OLDENBURG.

PHILOSOPHICAL TRANSACTIONS.

Munday, March 6. 166$\frac{6}{7}$.

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The Introduction.

WHereas there is nothing more neceſſary for promoting the improvement of Philoſophical Matters, than the communicating to ſuch, as apply their Studies and Endeavors that way, ſuch things as are diſcovered or put in practice by others; It is therefore thought fit to employ the *Preſs*, as the moſt proper way to gratifie thoſe, whoſe engagement in ſuch Studies, and delight in the advancement of Learning and profitable Diſcoveries, doth entitle them to the knowledge of what this Kingdom, or other parts of the World, do, from time to time, afford, as well

of the Progreſs of the Studies, Labors, and attempts of the Curious and Learned in things of this kind, as of their complete Diſcoveries and Performances: To the end, that ſuch Productions being clearly and truly communicated, deſires after ſolide and uſeful knowledge may be further entertained, ingenious Endeavors and Undertakings cheriſhed, and thoſe, addicted to and converſant in ſuch Matters, may be invited and encouraged to ſearch, try, and find out new things, impart their knowledge to one another, and contribute what they can to the Grand Deſign of improving Natural knowledge, and perfecting all *Philoſophical Arts*, and *Sciences*. All for the Glory of God, the Honor and Advantage of theſe Kingdoms, and the Univerſal Good of Mankind.

An Accompt of the improvement of Optick Glaſſes.

There came lately from *Paris* a Relation, concerning the Improvement of *Optick Glaſſes*, not long ſince attempted at *Rome* by Signor *Giuſeppe Campani*, and by him diſcourſed of, in a Book, Entituled, *Ragguaglio di nuoue Oſſervationi*, lately printed in the ſaid City, but not yet tranſmitted into theſe parts; wherein theſe following particulars, according to the Intelligence, which was ſent hither, are contained.

The *Firſt* regardeth the excellency of the long *Teleſcopes*, made by the ſaid *Campani*, who pretends to have found a way to work great *Optick Glaſſes* with a Turne-tool; without any Mould: And whereas hitherto it hath been found by Experience, that *ſmall* Glaſſes are in proportion better, to ſee with, upon the Earth, then the *great* ones; that Author affirms, that his are equally good for the Earth, and for making Obſervations in the Heavens. Beſides, he uſeth three Eye-Glaſſes for his great *Teleſcopes*, without finding any *Iris*, or ſuch Rain-bow colors, as do uſually appear in ordinary Glaſſes, and prove an impediment to Obſervations.

The *Second*, concerns the *Circle of Saturn*, in which he hath obſerved nothing, but what confirms Monſieur *Chriſtian Huygens de Zulichem* his Syſteme of that Planet, publiſhed by that worthy Gentleman in the year, 1659.

The

The *Third*, reſpects *Jupiter*, wherein *Campani* affirms he hath obſerved by the goodneſs of his Glaſſes, certain *protuberancies* and *inequalities*, much greater then thoſe that have been ſeen therein hitherto. He addeth, that he is now obſerving, whether thoſe ſallies in the ſaid *Planet* do not change their ſituation, which if they ſhould be found to do, he judgeth, that *Jupiter* might then be ſaid to turn upon his *Axe*; which, in his opinion, would ſerve much to confirm the opinion of *Copernicus*. Beſides this, he affirms, he hath remarked in the *Belts* of *Jupiter*, the ſhaddows of his *ſatellites*, and followed them, and at length ſeen them emerge out of his Disk.

A Spot in one of the Belts of Jupiter.

The Ingenious Mr. *Hook*, did, ſome months ſince, intimate to a friend of his, that he had, with an excellent twelve foot Teleſcope, obſerved, ſome days before, he then ſpoke of it, (*videl.* on the ninth of *May*, 1664. about 9 of the Clock at night) a ſmall Spot in the biggeſt of the 3 obſcurer *Belts* of *Jupiter*, and that, obſerving it from time to time, he found, that within 2 hours after, the ſaid Spot had moved from Eaſt to Weſt, about half the length of the Diameter of *Jupiter*.

The Motion of the late Comet prædicted.

There was lately ſent, to one of the *Secretaries* of the *Royal Society* a Packet, containing ſome Copies of a Printed Paper, Entituled, The *Ephemerides* of the *Comet*, made by the ſame Perſon, that ſent it, called *Monſieur Auzout*, a *French* Gentleman of no ordinary Merit and Learning, who deſired, that a couple of them might be recommended to the ſaid *Society*, and one to their *Preſident*, and another to his Highneſs Prince *Rupert*, and the reſt to ſome other Perſons, nominated by him in a Letter that accompanied this preſent, and known abroad for their ſingular abilities and knowledge in Philoſophical Matters. The end of the Communication of this Paper was, That, the motion of the *Comet*, that hath lately appeared, having been prædicted by the ſaid *Monſieur Au-*

zout, after he had ſeen it (as himſelf affirms) but 4 or 5 times, the *Virtuoſi* of *England*, among others, might compare alſo their Obſervations with his *Ephemerides*, either to confirm the *Hypotheſis*, upon which the *Author* had before hand calculated the way of this Star, or to undeceive him, if he be in a miſtake. The ſaid Author Dedicateth theſe his conceptions to the moſt Chriſtian King, telling him, that he preſents Him with a deſign, which never yet was undertaken by any *Aſtronomer*; all the World having been hitherto perſwaded, that the motions of *Comets* were ſo irregular, that they could not be reduced to any Laws, and men having contented themſelves, to obſerve exactly the places, through which they *did* paſs; but no man, that he knows, having been ſo bold as to venture to foretel the places, through which they *ſhould* paſs, and where they ſhould ceaſe to appear: Whereas he exhibits here the *Ephemerides*, determining day by day, in what place of the Heavens this *Comet* ſhall be, at what hour it ſhall be in its *Meridian*, and at what hour it ſhall ſet; until its too great remoteneſs, or the approach of the Sun, hide it from our eyes. Deſcending to particulars, he ſaith, that this Star, being diſengaged from the beams of the Sun, might have been obſerved, if his conjectures be good, ever ſince it hath been of 17 or 18 degrees *Southern Latitude*, and that about the middle of *November* laſt, and ſooner, unleſs it have been too ſmall: That however it hath been ſeen in *Holland* ever ſince the 2*d.* of *December* laſt, at which time, according to his reckoning, the Diurnal motion of the *Comet* ſhould already amount to 17 or 18 minuts. He finds, that this Star moveth *juſt enough* in the Plan of a *Great Circle*, which inclineth to the *Equinoctial* about 30 degrees, and to the *Ecliptick* about 49 *d.* or 49 $\frac{1}{2}$, cutting the *Equator* at about 45 *d.* $\frac{1}{2}$, and the *Ecliptick* at the 28 *d.* of *Aries*, or a little more. He ſaith *juſt enough*, becauſe he thinks, there may perhaps be ſome *parallaxe*; which he wiſheth could be determined.

Hence, (*ſo he goes on*) every one who pleaſeth may ſee, in tracing the *Comet* upon the *Globe*, through, or by which Starrs it hath paſſed and ſhall paſs; adding, that there will be *neither* cauſe to wonder, that having deſcended to about 6. degr. beneath the *Tropick* of *Capricorn*, he hath remounted afterwards, and ſhall go on

on aſcending ſo, as to paſs the *Æquinoctial*, and perhaps proceed to 15. degrees *Northern Declination*, if it do not diſappear before that time, by reaſon of its remoteneſs: *Nor* to believe, that there have been two *Comets*, upon its being ſeen again the 31. of *December*; ſince, according to him, it ought to have been ſo, if it continue to move in a *Great Circle*.

Having hereupon ſhewed, how the motion is to be traced upon the *Globe*, he finds, that, according to his Calculation, this Comet was to paſs the *Tropick* of *Capricorn* about the 16. of *December*, and being entred into the Sign of *Virgo* on the 20. of the ſame month, and having been in *Quadrat* with the *Sun*, it ſhould ſtill deſcend, until the 26. of *December* in the morning, and then enter into *Leo*; that having entred, the 28. of the ſame month, into *Cancer*, and been, a little after that time, in its greateſt Inclination to the *Ecliptick*, vid. in the 28. degree of *Leo*, it was to repaſs the *Southern Tropick*, over againſt the *little Dogg*, on the 29. of *December* about 9. or 10. of the clock in the morning, after it had been oppoſite to the *Sun* 2. or 3. hours before; and that on the 29. of *December* in the evening it ſhould be in *Gemini*; and at the very beginning of the New year, enter into *Taurus*.

After this, our Author finds, that this *Comet*, according to his account, ſhould paſs the *Æquator* on the 4. of *January* before noon, and that about 5. or 6. of the clock in the evening of that day it was to come into the Jaw of the *Whale*, and the 9. of the ſame, at 6. of the clock, it ſhould come cloſe to the ſmall Starr of the *Whale*, which is in its way, a little below. At length, he finds that it was to enter into *Aries* on the 12. of *January*, and to cut the *Ecliptick* on the 16. of the ſame month about noon, at which time it was to be again in *Quadrat* with the *Sun*, whence drawing a little to above the *Northern Line* of *Piſces*, it ſhould in his opinion ceaſe to appear a little beyond that place, without going as far as to the middle of *Aries*, if ſo be that its remoteneſs make it not diſappear ſooner.

He continueth, and ſaith, that this *Comet* ſhall not arrive to the place over againſt the *Line* of *Piſces*, till the 10. of *February*, & that then its *Diurnal* motion ſhall not exceed 8. minuts; and not 5. minuts about the 20. of the ſame month: and that in the beginning

ginning of *March*, if we ſee it ſo long, the ſaid motion ſhall not exceed 4. minuts, and ſo ſhall be ſtill diminiſhing; except the *Comet* become *Retrograde*, which, as very important, he would have well obſerved; as alſo, whether its motion will be about the end more or leſs ſwift, then he hath calculated it.

He ſubjoyneth, that the greateſt way, which this Star could make in 24. hours, hath been 13. *d.* 25'; and in one hour, about 34'; and thinking it probable, that about the time, when it made ſo much way, it ſhould be neereſt to the *Earth*, he concludeth that its motion in 24. hours muſt be, in its leaſt diſtance from the *Earth*, as about 3. to 14, or 1. to $4\frac{2}{3}$, and that its motion in one hour was to be to the ſame leaſt diſtance, as about 1. to $102\frac{1}{7}$.

But that, which he Judgeth moſt remarkable, is, that he found by his Calculation, that the ſaid leaſt diſtance ſhould be on the 29. of *December*, when the *Comet* was oppoſite to the *Sun*; which he does not know whether it may not ſerve to decide the grand Queſtion concerning the *Motion of the Earth*.

He taketh further notice, that the *Tayl* of the *Comet* was to turn *Weſtward*, with a point to the *North*, until the 29. of *December*, at which time it was to be oppoſite to the *Sun*, and that then the ſaid *Tayl* was to look directly *North*; but that, after that time, the *Tayl* was to turn *Eaſtward*, and continue to do ſo, until it diſappear; and that it ſhall draw a little towards the *North*, until the 8. or 10. of *February*, at which time the *Tayl* is to be parallel to the *Æquator*, and if the *Comet* be *yet* ſeen for ſome time after, the *Tayl* ſhall go a little lower towards the *South*, but grow ſmaller.

He finds by his *Hypotheſis*, that on the 2. of *December*, which is the firſt obſervation, that he hath heard of, this Star was to be about 7. times more remote from the *Earth*, then when it was in its *Perigeum*; and that it will be again in an equal remoteneſs from the *Earth*, on the 27. of *January*; ſo that he is of opinion, that in caſe this *Comet* have not been ſeen before the 2. of *December* it will not be ſeen any more after the 27. of *January*.

He wiſhes above all things, that it might be very exactly obſerved, at what Angle the way of the *Comet* cuts the *Æquator*, and, moſt of all, the *Ecliptick*; that ſo it may be ſeen, whether there

there hath not been ſome *Parallaxe* in the *Circle* of his Motion; as alſo, that ſome obſervations could be had of its greateſt deſcent beneath the *Tropick* of *Capricorn* in the more *Southern* parts, where he ſaith it would have been without *Refractions*; Moreover, of the Time, when it hath been in *Quadrat* with the *Sun*, about the 20. of *December*; and that alſo very exact Obſervation might be made of the time of its being again in *Quadrat* with the *Sun*, which, according to him, was to be *Januar.* 16.

He wiſhes alſo, that ſome in *Madagaſcar* may have obſerved this Star; Seeing that it began to appear over the middle of that *Iſland*, and paſſed twice over their Heads; he judgeth, that they have ſeen it before us. And he wiſhes laſtly, that there were ſome intelligent perſon in *Guiana* to obſerve it there, ſeeing that within a few daies, according to his reckoning, it will paſs over their Heads, and will not remove from thence but 8. or 10. degrees Northward, where he ſaith, it will diſappear; thinking it improbable, that it can ſtill appear, after the *Sun* ſhall have paſſed it.

This Account beareth date of the 2. *January*, new ſtile, 1665, and the Author thereof addeth this Note, That, ſeeing it could not be printed nor diſtributed ſo ſoon as he deſired, he hath had the opportunity to verifie it by ſome Obſervations, from which he affirms he hath found no ſenſible difference; or, if there be, that it proceeds only from thence, that the Stars have advanced, ſince his *Globe* was made. He concludeth, that if this continue, and the firſt Obſervations do likewiſe agree, or that the differences do arrive within the Times, gheſſed by him, that he hopes, he ſhall determine both the *Diſtance* and the *Magnitude* of this *Comet*; and that perhaps one may be enabled to decide the Queſtion of the *Motion of the Earth.* In the interim, he aſſureth, that he hath not changed the leaſt number in his Calculations, and that *Monſieur Huygens*, & ſeveral French Gentlemen, to whom, he ſaith, he hath given them long ſince, can bear him witneſs that he hath done ſo; as alſo many other friends of his, who ſaw upon his *Globe*, ſeveral daies before, the way of the *Comet* from day to day.

Thus farr the *Pariſian* Account of the Comet, which is here inſerted at large, that the intelligent and curious in *England* may compare

compare their Obſervations therewith, either to verifie theſe *Predictions*, or to ſhew wherein they differ; which is (as was alſo hinted above) the deſign of this *Philoſophical Prophet* in diſperſing his Conceptions, who declareth himſelf ready, in caſe he be miſtaken in his reckoning, to learn another *Hypotheſis*, to explicate theſe admirable appearances by

An Experimental Hiſtory of Cold.

There is in the Preſs, a New *Treatiſe*, entituled, *New Obſervations and Experiments in order to an Experimental Hiſtory of Cold*, begun by that Noble Philoſopher, Mr. *Robert Boyle*, and in great part already Printed; He did lately very obligingly preſent ſeveral Copies of ſo much as was Printed, to the *Royal Society*, with a deſire that ſome of the Members thereof might be engaged to peruſe the Book, and ſelect out of it for trial, the hints of ſuch Experiments, as the *Authour* there wiſheth might be either yet made or proſecuted. The Heads thereof are,

1. Experiments touching Bodies capable of Freezing others.
2. Experiments and Obſervations touching Bodies Diſpoſed to be Frozen.
3. Experiments touching Bodies, Indiſpoſed to be Frozen.
4. Experiments and Obſervations touching the Degrees of Cold in ſeveral Bodies.
5. Experiments touching the Tendency of Cold Upwards or Downwards.
6. Experiments and Obſervations touching the Preſervation and Deſtruction of (Eggs, Apples, and other) Bodies by Cold.
7. Experiments touching the Expanſion of Water and Aqueous Liquors by Freezing.
8. Experiments touching the Contraction of Liquors by Cold.
9. Experiments in Conſort, touching the Bubbles, from which the Levity of Ice is ſuppoſed to proceed.
10. Experiments about the Meaſure of the Expanſion and the Contraction of Liquors by Cold.
11. Experiments touching the Expanſive Force of Freezing Water.
12. Experiments touching a New way of eſtimating the Expanſive

ſive force of Congelation, and of highly compreſſing Air without Engines.

13. Experiments and Obſervations touching the Sphere of Activity of Cold.

14. Experiments touching differing *Mediums*, through which Cold may be diffuſed.

15. Experiments and Obſervations touching Ice.

16. Experiments and Obſervations touching the duration of Ice and Snow, and the deſtroying of them by the Air, and ſeveral Liquors.

17. Conſiderations and Experiments touching the *Primum Frigidum.*

18. Experiments and Obſervations touching the Coldneſs and Temperature of the Air.

19. Of the ſtrange Effects of Cold.

20. Experiments touching the weight of Bodies frozen and unfrozen.

21. Promiſcuous Experiments and Obſervations concerning Cold.

This Treatiſe will be diſpatched within a very ſhort time, and would have been ſo, ere this, if the extremity of the late Froſt had not ſtopt the Preſs. It will be accompanied with ſome Diſcourſes of the ſame *Authour*, concerning *New Thermometrical Experiments and Thoughts*, as alſo, with an Exercitation about the *Doctrine of the Antiperiſtaſis:* In the former whereof is *firſt* propoſed this *Paradox*, That not onely our Senſes, but common Weather-glaſſes, may miſ-inform us about Cold. *Next*, there are contained in this part, New Obſervations about the deficiencies of Weather-glaſſes, together with ſome conſiderations touching the New or *Hermetical* Thermometers. *Laſtly*, they deliver another *Paradox*, touching the cauſe of the Condenſation of the Air, and Aſcent of water by Cold in common Weather-glaſſes. The latter piece of this part contains an Examen of *Antiperiſtaſis*, as it is wont to be *taught* and *proved:* Of all which there will, perhaps, a fuller account be given by the Next.

An Account of a very odd Monſtrous Calf.

By the ſame Noble perſon was lately communicated to the *Royal Society* an Account of a very Odd Monſtrous Birth, produced at *Limmington* in *Hampſhire*, where a Butcher, having cauſed a Cow (which caſt her Calf the year before) to be covered that ſhe might the ſooner be fatted, killed her when fat, and opening the Womb, which he found heavy to admiration, ſaw in it a Calf, which had begun to have hair, whoſe hinder Leggs had no Joints, and whoſe Tongue was, *Cerberus*-like, triple, to each ſide of his Mouth one, and one in the midſt: Between the Fore-leggs & the Hinder-leggs was a great Stone, on which the Calf rid: The *Sternum*, or that part of the Breaſt, where the Ribs lye, was alſo perfect Stone; & the Stone, on which it rid, weighed twenty pounds and a half; the outſide of the Stone was of Greeniſh colour, but ſome ſmall parts being broken off, it appeared a perfect Freeſtone. The Stone, according to the Letter of Mr. *David Thomas*, who ſent this Account to Mr. *Boyle*, is with Doctor *Haughteyn* of *Salisbury*, to whom he alſo referreth for further Information.

Of a Peculiar Lead-Ore of Germany, and the Uſe thereof.

There was, not long ſince, ſent hither out of *Germany* from an inquiſitive Phyſician, a Liſt of ſeveral *Minerals* and *Earths* of that Country, and of *Hungary*, together with a *Specimen* of each of them: among which there was a kind of *Lead-Ore*, which is more conſiderable then all the reſt, becauſe of its ſingular uſe for *Eſſays* upon the *Coppell*, ſeeing that there is not any other *Mettal* mixed with it. 'Tis found in the *Upper-Palatinate*, at a place called *Freyung*, and there are two ſorts of it, whereof one is a kind of Cryſtalline Stone, and almoſt all good Lead; the other not ſo rich, and more farinaceous. By the information, coming along with it, they are fetcht, not from under the ground, but, the Mines of that place having lain long neglected, by reaſon of the Wars of *Germany* and the increaſe of Waters, the people, living there-

thereabout, take it from what their Forefathers had thrown away, and had lain long in the open Air. The uſe above-mentioned being conſiderable, the perſon, who ſent it, hath been intreated, to inform what quantities may be had of it, if there ſhould be occaſion to ſend for ſome.

Of an Hungarian Bolus, of the ſame Effect with the Bolus Armenus.

The ſame perſon gave notice alſo, that, beſides the *Bolus Armenus*, and the *Terra Sileſiaca*, there is an Earth to be found in *Hungary* about the river *Tockay*, thence called *Bolus Tockavienſis*, having as good effects in *Phyſick*, as either of the former two, and commended by experience in thoſe parts, as much as it is by *Sennertus* out of *Crato*, for its goodneſs.

Of the New American *Whale-fiſhing about the* Bermudas.

Here follows a Relation, ſomewhat more divertiſing, then the precedent Accounts; which is about the new *Whale-fiſhing* in the *Weſt-Indies* about the *Bermudas*, as it was delivered by an underſtanding & hardy Sea-man, who affirmed he had been at the killing work himſelf. His account, as far as remembred, was this; That though hitherto all Attempts of maſtering the Whales of thoſe Seas had been unſuccesful, by reaſon of the extraordinary fierceneſs and ſwiftneſs of theſe monſtrous Animals; yet the enterpriſe being lately renewed, and ſuch perſons choſen and ſent thither for the work, as were reſolved not to be baffled by a Sea-monſter, they did proſper ſo far in this undertaking, that, having been out at Sea, neer the ſaid Iſle of *Bermudas*, ſeventeen times, and faſtned their Weapons a dozen times, they killed in theſe expeditions two old Female-Whales, and three Cubs, whereof one of the old ones, from the head to the extremity of the Tayl, was 88. Foot in length, by meaſure; its Tayl being 23. Foot broad, the ſwimming Finn 26. Foot long, and the Gills three Foot long: having great bends underneath from the Noſe to the Navil; upon her after-part, a Finn on the back; being within

paved (this was the plain Sea-mans phraſe) with fat, like the Cawl of a Hog.

The other old one, he ſaid, was ſome 60. Foot long. Of the Cubs, one was 33, the other two, much about 25. or 26. Foot long.

The ſhape of the Fiſh, he ſaid, was very ſharp behind, like the ridge of a houſe: the head pretty bluff, and full of bumps on both ſides: the back perfectly black, and the belly white.

Their celerity and force he affirmed to be wonderful, inſomuch that one of thoſe Creatures, which he ſtruck himſelf, towed the boat wherein he was, after him, for the ſpace of ſix or ſeven Leagues, in $\frac{1}{4}$ of an hours time. Being wounded, he ſaith, they make a hideous roaring, at which, all of that kind that are within hearing, come towards the place, where the Animal is, yet without ſtriking, or doing any harm to the wary.

He added, that they ſtruck one of a prodigious bigneſs, and by gheſs of above 100. foot long. He is of opinion, that this Fiſh comes neereſt to that ſort of Whales, which they call the *Jubartes*; they are without teeth, and longer then the *Greenland*-Whales, but not ſo thick.

He ſaid further, that they fed much upon Graſs, growing at the bottom of the Sea; which, he affirmed, was ſeen by cutting up the great Bag or Maw, wherein he had found in one of them about two or three Hogſheads of a greeniſh graſſy-matter.

As to the quantity and nature of the Oyl which they yield, he thought, that the largeſt ſort of theſe Whales might afford ſeven or eight Tuns if well huſbanded, although they had loſt much this firſt time, for want of a good Cooper, having brought home but eleven Tuns. The Cubbs, by his relation, do yield but little, and that is but a kind of Jelly. That which the old ones render, doth candy, like Porks-Greaſe, yet burneth very well. He obſerved, that the Oyl of the Blubber is as clear and fair as any Whey: but that which is boyled out of the Lean, interlarded, becomes as hard as Tallow, ſpattering in the burning; and that which is made of the Cawl, reſembleth Hoggs-greaſe.

One, but ſcarce credible, quality of this Oyl, he affirms to be, that though it be boiling, yet one may run ones hand into it without ſcalding; to which he adds, that it hath a very healing

Vertue

Vertue for cuttings, lameneſs, *&c.* the part affected being anointed therewith. One thing more he related, not to be omitted, which is, that having told, that the time of catching theſe Fiſhes was from the beginning of *March*, to the end of *May*, after which time they appeared no more in that part of the Sea: he did, when aſked, whither they then retired, give this Anſwer, That it was thought, they went into the Weed-beds of the Gulf of *Florida*, it having been obſerved, that upon their Fins and Tails they have ſtore of Clams or Barnacles, upon which, he ſaid, Rock-weed, or Sea-tangle did grow a hand long; many of them having been taken of them, of the bigneſs of great Oyſter-ſhells, and hung upon the Governour of *Bermudas* his Pales.

A Narrative concerning the ſucceſs of Pendulum-Watches at Sea for the Longitudes.

The Relation lately made by Major *Holmes*, concerning the ſucceſs of the *Pendulum-Watches* at Sea (two whereof were committed to his Care and Obſervation in his laſt voyage to *Guiny* by ſome of our Eminent *Virtuoſi*, and Grand Promotors of Navigation) is as followeth;

The ſaid *Major* having left that Coaſt, and, being come to the Iſle of St. *Thomas* under the *Line*, accompanied with four Veſſels, having there adjuſted his Watches, put to Sea, and ſailed Weſtward, ſeven or eight hundred Leagues, without changing his courſe; after which, finding the Wind favourable, he ſteered towards the Coaſt of *Africk*, North-North-Eaſt. But having ſailed upon that *Line* a matter of two or three hundred Leagues, the Maſters of the other Ships, under his Conduct, apprehending that they ſhould want Water, before they could reach that Coaſt, did propoſe to him to ſteer their Courſe to the *Barbadoes*, to ſupply themſelves with Water there. Whereupon the ſaid Major, having called the Maſters and Pilots together, and cauſed them to produce their Journals and Calculations, it was found, that thoſe Pilots did differ in their reckonings from that of the Major, one of them eighty Leagues, another about an hundred, and the third, more; but the Major judging by his *Pendul-Watches*, that they were onely ſome thirty Leagues diſtant from

the

the Iſle of *Fuego*, which is one of the Iſles of *Cape Verd*, and that they might reach it next day, and having a great confidence in the ſaid Watches, reſolved to ſteer their Courſe thither, and having given order ſo to do, they got the very next day about Noon, a ſight of the ſaid Iſle of *Fuego*, finding themſelves to ſail directly upon it, and ſo arrived at it that Afternoon, as he had ſaid. Theſe Watches having been firſt Invented by the Excellent Mounſieur *Chriſtian Hugens* of *Zulichem*, and fitted to go at Sea, by the Right Honourable, the Earl of *Kincardin*, both Fellows of the *Royal Society*, are now brought by a New addition to a wonderfull perfection. The ſaid Monſieur *Hugens*, having been informed of the ſucceſs of the Experiment, made by Major *Holmes*, wrote to a Friend at *Paris* a Letter to this effect;

Major *Holmes*, at his return, hath made a relation concerning the uſefulneſs of *Pendulums*, which ſurpaſſeth my expectation. I did not imagine that the Watches of this firſt Structure would ſucceed ſo well, and I had reſerved my main hopes for the New ones. But ſeeing that thoſe have already ſerved ſo ſucceſfully, and that the other are yet more juſt and exact, I have the more reaſon to believe, that the Invention of *Longitudes* will come to its perfection. In the mean time, I ſhall tell you, that the *States* did receive my Propoſition, when I deſired of them a Patent for theſe New Watches, and the recompenſe ſet a-part for the invention in caſe of ſucceſs; and that without any difficulty they have granted my requeſt, commanding me to bring one of theſe Watches into their Aſſembly, to explicate unto them the Invention, and the application thereof to the *Longitudes*; which I have done to their contentment. I have this week publiſhed, that the ſaid Watches ſhall be expoſed to ſale, together with an Information neceſſary to uſe them at Sea: and thus I have broken the Ice. The ſame Objection, that hath been made in your parts againſt the exactneſs of theſe *Pendulums*, hath alſo been made here; to wit, that though they ſhould agree together, they might fail both of them, by reaſon that the Air at one time might be thicker, then at another. But I have anſwered, that this difference, if there be any, will not be at all perceived in the *Penduls*, ſeeing that the continual Obſervations, made in Winter from day to day, until Summer, have ſhewed me, that they

they have always agreed with the Sun. As to the Printing of the *Figure* of my New Watch, I ſhall defer that yet a while: but it ſhall in time appear with all the Demonſtrations thereof, together with a *Treatiſe* of *Pendulums*, written by me ſome days ſince, which is of a very ſubtile Speculation.

The Character, lately publiſhed beyond the Seas, of an Eminent Perſon, not long ſince dead at Tholouſe, *where he was a Councellor of Parliament.*

It is the deſervedly famous *Monſieur de Fermat*, who was, (ſaith the Author of the Letter) one of the moſt Excellent Men of this Age, a *Genius* ſo univerſal, and of ſo vaſt an extent, that if very knowing and learned Men had not given teſtimony of his extraordinary merit, what with truth can be ſaid of him, would hardly be believed. He entertained a conſtant correſpondence with many of the moſt Illuſtrious Mathematicians of *Europe*, and did excel in all the parts of Mathematical Science: a Teſtimony whereof he hath left behind him in the following Books.

A Method for the Quadrature of *Parabola's* of all degrees.

A Book *De Maximis & Minimis*, which ſerveth not only for the determination of Problems of *Plains* and *Solids*, but alſo for the invention of *Tangents* and *Curve Lines*, and of the *Centres* of Gravity in Solids; and likewiſe for Numerical Queſtions.

An Introduction to the Doctrine of *Plains* and *Solids*, which is an *Analytical* Treatiſe, concerning the ſolution of *Plains* and *Solids*, which had been ſeen (as the Advertiſer affirms) before Monſieur *Des Cartes* had publiſh'd any thing upon this Subject.

A Treatiſe *De Contactibus Sphæricis*, where he hath demonſtrated in *Solids*, what Mr. *Viet*, Maſter of Requeſts, had but demonſtrated in *Plains*.

Another Treatiſe, wherein he eſtabliſheth and demonſtrateth the two Books of *Apollonius Pergæus*, of *Plains*.

And a General Method for the dimenſion of *Curve Lines*, *&c.* Beſides, having a perfect knowledge in Antiquity, he was conſulted from all parts upon the difficulties that did emerge therein: he hath explained abundance of obſcure places, that are found

found in the Antients. There have been lately printed ſome of his Obſervations upon *Athenæus*; and he that hath interpreted *Benedetto Caſtelli*, of the Meaſure of running waters, hath thence inſerted in his Work a very handſome one upon an Epiſtle of *Syneſius*, which was ſo difficult, that the Jeſuit *Petavius*, who hath commented upon this Author, acknowledges, that he could not underſtand it.

He hath alſo made many Obſervations upon *Theon of Smyrne*, and upon other Antient Authors: but moſt part of them are not found but ſcattered in his Epiſtles, becauſe he did not write much upon theſe kinds of Subjects, but to ſatisfie the curioſity of his friends.

All theſe Mathematical Works, and all theſe curious ſearches in Antiquity, did not hinder this great *Virtuoſo* from diſcharging the duties of his place with much aſſiduity, and with ſo much ability, that he hath had the reputation of one of the greateſt *Civilians* of his Age.

But that, which is moſt of all ſurpriſing to many, is, that with all that ſtrength of underſtanding, which was requiſite to make good theſe rare qualities, lately mentioned, he had ſo polite and delicate parts, that he compoſed *Latin*, *French* and *Spaniſh* Verſes with the ſame elegancy, as if he had lived in the time of *Auguſtus*, and paſſed the greateſt part of his life at the Courts of *France* and *Spain*.

More particulars will perhaps be mention'd of the Works of this Rare perſon, when all things, that he hath publiſh'd, ſhall be recovered, and when liberty ſhall be obtained of his Worthy Son, to impart unto the World the reſt of his Writings, hitherto unpubliſhed.

Printed with Licence, For *John Martin*, and *James Alliſtry*,
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Fig: II

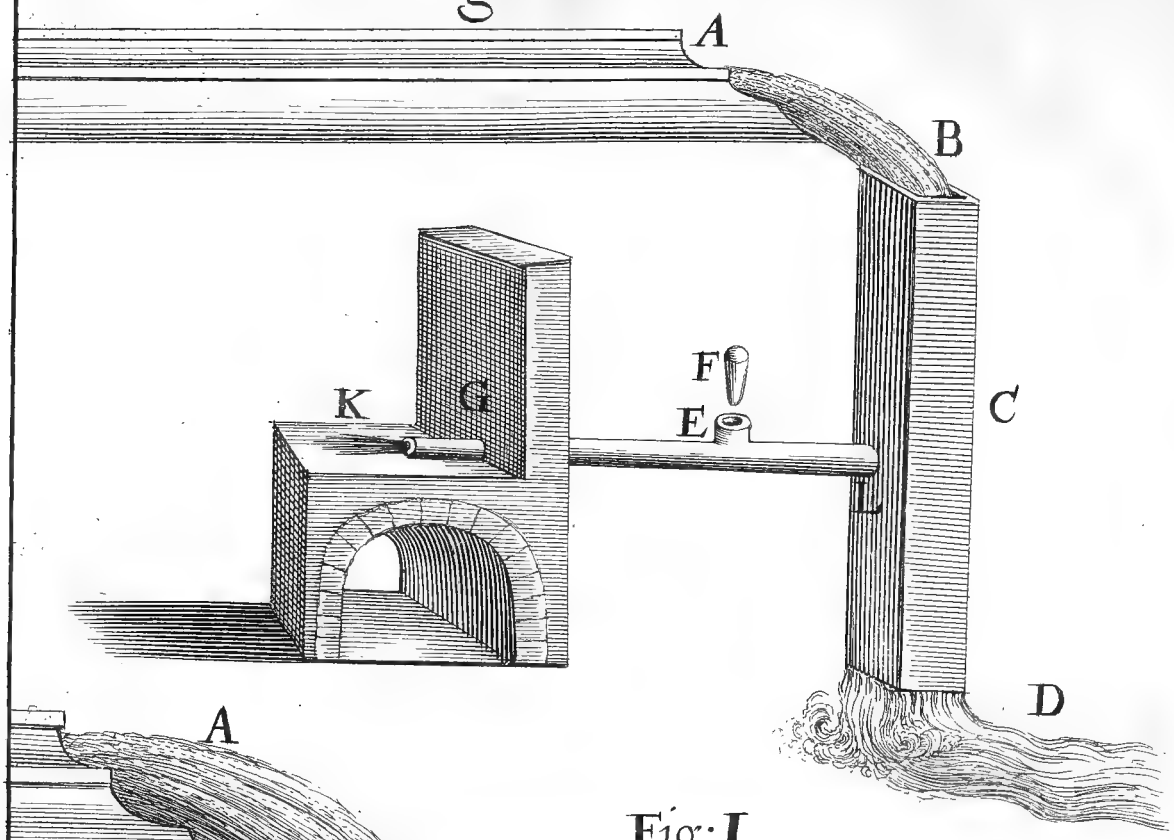
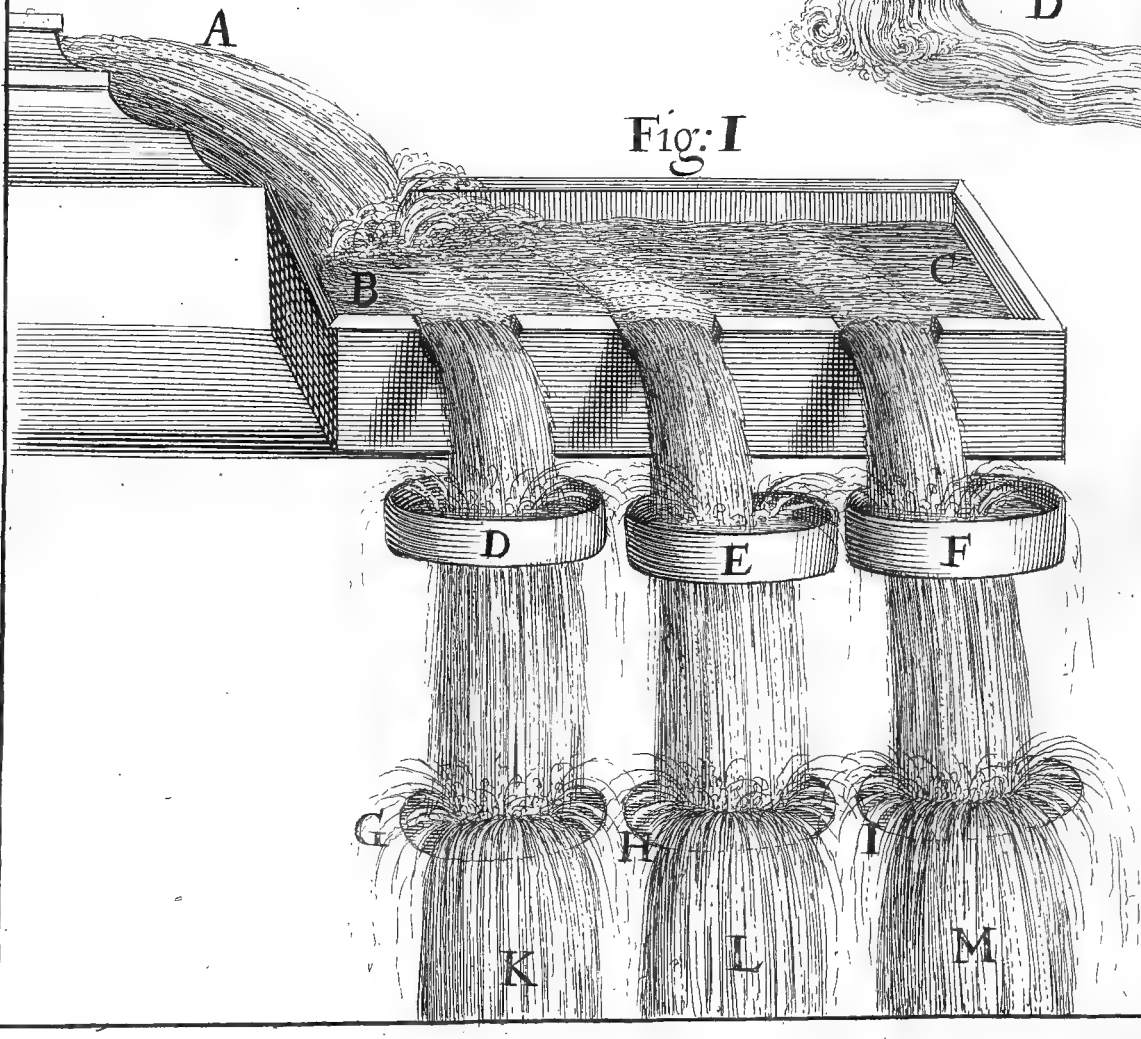


Fig: I



PHILOSOPHICAL TRANSACTIONS.

Munday, April 3. 1665.

The Contents.

Extract of a Letter written from Rome, *concerning the late* Comet, *and a* New *one. Extract of another Letter from* Paris, *containing ſome Reflexions on the precedent* Roman *Letter. An Obſervation concerning ſome particulars, further conſiderable in the* Monſter, *that was mention'd in the firſt Papers of theſe* Philoſophical Tranſactions. *Extract of a Letter written from* Venice, *concerning the Mines of* Mercury *in* Friuly. *Some Obſervations, made in the ordering of* Silk-worms. *An Account of Mr.* Hooks Micrographia, *or the Phyſiological deſcriptions of* Minute Bodies, *made by* Magnifying Glaſſes.

Extract of a Letter, lately written from Rome, *touching the late Comet, and a New one.*

I Cannot enough wonder at the ſtrange agreement of the thoughts of that acute French Gentleman, Monſieur *Auzout*, in the *Hypotheſis* of the Comets motion, with mine; and particularly, at that of the *Tables*. I have with the ſame method, whereby I find the motion of this Comet, eaſily found the Principle of that Author's *Ephemerides*, which he then thought not fit to declare; and 'tis this, that this Comet moves about the *Great Dog*, in ſo great a Circle, that that portion, which is deſcribed,

bed, is exceeding ſmall in reſpect of the whole circumference thereof,and hardly diſtinguiſhable by us from a ſtreight line.

Concerning the New Comet you mention,I ſaw it on the 11. of *February*, about the 24. deg. of *Aries*, with a Northern latitude of 24. deg. 40. min. The cloudy weather hath not yet permitted me to ſee it in *Andromeda*, as others affirm to have done.

Extract of a Letter, written from Paris, *containing ſome Reflections on part of the precedent* Roman *Letter.*

As to the *Hypotheſis* of *Georg.Domenico Caſſini*.touching the motion of the *Comet* about the *Great Dog* in a Circle, whoſe Centre is in a ſtreight line drawn from the Earth thorough the ſaid Star, I believe it will ſhortly be publiſh'd in print, as a thought I lighted upon in diſcourſing with one of my Friends, who did maintain, that it turned about a Centre, becauſe that its *Perigee* had been over againſt the *Great Dog*, as I had noted in my *Ephemerides*. This particular I did long ſince declare to many of my acquaintance,whereof ſome or other will certainly do me that right, as to let the world know it by the Preſs. I have added an Obſervation, which I find not, that Signior *Caſſini* hath made,*viz.*that there was ground to think, that the *Comet* of 1652. was the ſame with the preſent, ſeeing that, beſides the parity of the ſwiftneſs of its motion, the *Perigee* thereof was alſo over againſt the *Great Dog*, if the Obſervations extant thereof,deceive not. But,to make it out,what ground I had for theſe thoughts, I ſaid, that if they were true, the Comet muſt needs accompliſh its revolution from 12. to 12. years, or thereabout. But, ſeeing it appears not by Hiſtory, that a Comet hath been ſeen at thoſe determinate diſtances of time, nor that over againſt the *Perigee* of all the other Comets,whereof particular obſervations are recorded, are alwaies found Stars of the firſt Magnitude, or ſuch others, as are very notable, beſides other reaſons, that might be alleged, I ſhall not purſue this ſpeculation; but rather

ſuggeſt

ſuggeſt what I have taken notice of in my reflexions upon former Comets, which is, that more of them enter into our Syſteme by the ſign of *Libra* and about *Spica virginis*, then by all the other parts of the Heavens. For, both the preſent Comet, and many others regiſtred in Hiſtory, have entred that way, and conſequently paſſed out of it by the ſign *Aries*; by which alſo many have entred.

I did found my *Hypotheſis* upon three Obſervations only, *viz.* thoſe of the 22, 26, and 31. of *December*. Nor have I done, as ſome have fancied of me, who having been able to obſerve the Comet, the 27, 28, 29, 30, and 31. of *December*, and to ſee the diminution of its motion, have judged, that I had only determined that diminution for the time to come, conform to the augmentation thereof in time paſſed until the 29. of *December*. For *January* 1. (on which day I compoſed my *Ephemerides*) I knew not (nor any perſon here) that the motion of the Comet did diminiſh; but on the contrary, moſt men believed, it was not the ſame Comet. But Signior *Caſſini* knows very well, that that was not neceſſary, ſeeing that two portions of a *Tangent* being given, and the *Angles* anſwering thereunto, 'tis eaſie to find the poſition and magnitude of its circle. The reaſon, which I think the true one, of the diminution of its Motion in Longitude, and of its Retrogradation, by me conjectured in my *Ephemerides*, I began to be aſſured of, *Febr.* 10. For until the ſixth, the Comet had alwaies advanced, as Signior *Caſſini* alſo hath very well noted: but after that day, I found that it returned in augmenting alwaies its Latitude. And I have conſtantly obſerved it, until *March* 8. between many Stars, which muſt be the ſame with theſe mention'd by *Caſſini*, whereof the number was ſo great, that I think, I ſaw of them *March* 6. with one *Aperture* of my Glaſs, more then 40. or 50. and eſpecially, above the head of *Aries*; but I did not particularly note the ſituation of more than 12. or 15; amongſt which I have obſerved the poſition of the Comet ſince *January* 28. every day, when the weather did permit, *viz.* *January* 29. *February* 3, 6, 10, 17, 19, 24, 26, 27. and *March* 6, 7, 8.

7, 8. I left it on *March* 8. at the 18. of the Horn of *Aries*, almoſt in the ſame latitude; and I am apt to believe, it will be Eclipſed; which I wiſh I may be able to obſerve this evening, if it be not already paſſed.

If Signior *Caſſini* hath obſerved it on thoſe daies that I have, he will be glad to find the conformity of our Obſervations. I ſhall only add, that on *February* 3. we were ſurprized, to ſee the Comet again much brighter then ordinary, and with a conſiderable Train. Some did believe, that it approach'd again to us. But having beheld it with a *Teleſcope*, I ſoon ſaid, that it was joyned with two ſmall Stars, whereof one was pretty bright, which I had already ſeen, on *February* 28. and 29: And this conjunction gave the *Comet* that brightneſs, as it happens to moſt of the Starrs of the fifth and ſixth magnitude, where 2 or 3. or more are conjoyned, which perhaps would ſhew but faintly ſingle, though by reaſon of their proximity to one another, they appear but one ſtarr. Hence it was, that I aſſured my friends here, that the following days we ſhould no more ſee it ſo bright, becauſe I knew, that there were none ſuch ſmall bright Stars in the way, which by my former obſervations I conjectured it was to move.

An Obſervation imparted to the Noble Mr. Boyle, *by Mr.* David Thomas, *touching ſome particulars further conſiderable in the* Monſter *mentioned in the firſt Papers of theſe* Philoſophical Tranſactions.

Upon the ſtricteſt inquiry, I find by one, that ſaw the Monſtrous Calf and ſtone, within four hours after it was cut out of the Cows belly, that the Breaſt of the Calf was not ſtony (as I wrote) but that the skin of the Breaſt and between the Legs and of the Neck (which parts lay on the ſmaller end of the ſtone) was very much thicker, then on any other part, and that the Feet of the Calf were ſo parted as to be like the Claws of a Dog. The ſtone I have ſince ſeen; it is bigger at one end then

then the other; of no plain *Superficies*, but full of little cavities. The ſtone, when broken, is full of ſmall peble ſtones of an Ovall figure: its colour is gray like free-ſtone, but intermixt with veins of yellow and black. A part of it I have begg'd of Dr. *Haughten* for you, which I have ſent to *Oxford*, whither a more exact account will be conveyed by the ſame perſon.

Extract of a Letter, lately written from Venice *by the Learned Doctor* Walter Pope, *to the Reverend Dean of* Rippon, *Doctor* John Wilkins, *concerning the Mines of* Mercury *in* Friuli; *and a way of producing* Wind *by the fall of* Water.

The Mines of *Mercury* in *Friuli*, a Territory belonging to the *Venetians*, are about a days Journey and a half diſtant from *Goritia* Northwards, at a place call'd *Idria*, ſituated in a Valley of the *Julian Alps*. They have been, as I am inform'd, theſe 160. years in the poſſeſſion of the Emperor, and all the Inhabitants ſpeak the *Sclavonian* Tongue. In going thither, we travell'd ſeveral hours in the beſt Wood I ever ſaw before or ſince, being very full of *Firrs*, *Okes*, and *Beeches*, of an extraordinary thickneſs, ſtraitne's, and height. The Town is built, as uſually Towns in the *Alps* are, all of wood, the Church onely excepted, and another Houſe wherein the Overſeer liveth. When I was there, in *Auguſt* laſt, the Valley, and the Mountains too, out of which the *Mercury* was dugg, were of as pleaſant a verdure, as if it had been in the midſt of Spring, which they there attribute to the moiſtneſs of the *Mercury*; how truly, I diſpute not. That Mine, which we went into, the beſt and greateſt of them all, was dedicated to Saint *Barbara*, as the other Mines are to other Saints, the depth of it was 125. paces, every pace of that Country being, as they inform'd us, more then 5 of our Feet. There are two ways down to it; the ſhorteſt perpendicular way is that, whereby they bring up the Mineral in great Buckets, and

by

by which oftentimes ſome of the workmen come up and down. The other, which is the uſual way, is at the beginning not difficult, the deſcent not being much; the greateſt trouble is, that in ſeveral places you cannot ſtand upright: but this holds not long, before you come to deſcend in earneſt by perpendicular Ladders, where the weight of on's body is found very ſenſible. At the end of each Ladder, there are boards a croſs, where we may breath a little. The Ladders, as was ſaid, are perpendicular, but being imagined produced, do not make one Ladder, but ſeveral parallel ones. Being at the bottom, we ſaw no more then what we ſaw before, only the place, whence the Mineral came. All the way down, and the bottom, where there are ſeveral lanes cut out in the Mountain, is lined and propt with great pieces of Firr-trees, as thick as they can be ſet. They digg the Mineral with Pick-axes, following the veins: 'tis for the moſt part hard as a ſtone, but more weighty; of a Liver-colour, or that of *Crocus Metallorum*. I hope ſhortly to ſhew you ſome of it. There is alſo ſome ſoft Earth, in which you plainly ſee the *Mercury* in little particles. Beſides this, there are oftentimes found in the Mines round ſtones like Flints, of ſeveral bigneſſes, very like thoſe Globes of Hair, which I have often ſeen in *England*, taken out of Oxes bellys. There are alſo ſeveral *Marcaſites* and ſtones, which ſeem to have ſpecks of Gold in them; but upon tryal they ſay, they find none in them. Theſe round ſtones are ſome of them very ponderous, and well impregnated with *Mercury*; others, light, having little or none in them. The manner of getting the *Mercury* is this: They take of the Earth, brought up in Buckets, and put it into a Sive, whoſe bottom is made of wires at ſo great a diſtance, that you may put your finger betwixt them: 'tis carried to a ſtream of running water, and waſh'd as long as any thing will paſs through the Sive. That Earth which paſſeth not, is laid aſide upon an other heap: that which paſſeth, reſerved in the hole, G. in Fig. 1. and taken up again by the ſecond Man, and ſo on, to about ten or twelve ſives proportionably leſs. It often happens in the firſt hole, where the ſecond Man takes up his Earth

Earth, that there is *Mercury* at the bottom; but towards the farther end, where the intervals of the wires are leſs, 'tis found in very great proportion. The Earth laid aſide is pounded, and the ſame operation repeated. The fine ſmall Earth, that remains after this, and out of which they can waſh no more *Mercury*, is put into Iron retorts and ſtopt, becauſe it ſhould not fall into the Receivers, to which they are luted. The fire forces the *Mercury* into the Receivers: The Officer unluted ſeveral of them to ſhew us; I obſerved in all of them, that he firſt poured out perfect *Mercury*, and after that came a black duſt, which being wetted with water diſcover'd it ſelf to be *Mercury*, as the other was. They take the *Caput mortuum* and pound it, and renew the operation as long as they can get any *Mercury* out of it.

This is the way of producing the *Mercury*, they call *Ordinary*, which exceeds that, which is got by waſhing, in a very great proportion, as you will perceive by the account annext. All the *Mercury* got without the uſe of Fire, whether by waſhing, or found in the Mines (for in the digging, ſome little particles get together, ſo that in ſome places you might take up two or three ſpoonfuls of pure *Mercury*) is call'd by them *Virgin-Mercury*, and eſteem'd above the reſt. I inquir'd of the Officer what vertue that had more, then the other; he told me that making an *Amalgama* of Gold and *Virgin-Mercury*, and putting it to the fire, that *Mercury* would carry away all the Gold with it, which common *Mercury* would not do.

The Engins, employed in theſe Mines, are admirable; the Wheels, the greateſt that ever I ſaw in my life; one would think as great as the matter would bear: all moved by the dead force of the water, brought thither in no chargeable Aqueduct from a Mountain, 3 Miles diſtant: the water pumpt from the bottom of the Mine by 52 pumps, 26 on a ſide, is contrived to move other wheels, for ſeveral other purpoſes.

The Labourers work for a *Julio* a day, which is not above 6 or 7 pence, and indure not long; for, although none ſtay under

under ground above 6 hours; all of them in time (ſome later, ſome ſooner) become *paralytick*, and dye *hectick*.

We ſaw there a man, who had not been in the Mines for above half a year before, ſo full of *Mercury*, that putting a piece of *Braſs* in his mouth, or rubbing it in his fingers, it immediately became white like Silver: I mean, he did the ſame effect, as if he had rubb'd *Mercury* upon it, and ſo paralytick, that he could not with both his hands carry a Glaſs, half full of Wine, to his mouth without ſpilling it, though he loved it too well to throw it away.

I have been ſince informed, that here in *Venice*, thoſe that work on the back-ſide of Looking-glaſſes, are alſo very ſubject to the *Palſey*. I did not obſerve, that they had black Teeth; it may be therefore, that we accuſe *Mercury* injuſtly for ſpoiling the Teeth, when given in *Venereal* diſeaſes. I confeſs, I did not think of it upon the place; but, black Teeth being ſo very rare in this Country, I think I could not but have markt it, had all theirs been ſo.

They uſe exceeding great quantity of Wood, in making and repairing the Engins, and in the Furnaces (whereof there are 16, each of them carrying 24. Retorts;) but principally in the Mines, which need continual reparation, the Fir-trees laſting but a ſmall time under ground. They convey their Wood thus: About four miles from the Mines, on the ſides of two mountains, they cut down the Trees, and draw them into the interjacent Valley, higher in the ſame Valley, ſo that the Trees, according to the deſcent of the water lye betwixt it and *Idria*; with vaſt charges and quantities of Wood they make a Lock or Dam, that ſuffers not any water to paſs; they expect afterwards, till there be water enough to float theſe Trees to *Idria*; for, if there be not a ſpring, (as generally there is,) Rain, or the melting of the Snow, in a ſhort time, afford ſo much water, as is ready to run over the Dam, and which (the Flood-gates being open'd) carries all the Trees impetuouſly to *Idria*, where the Bridge is built very ſtrong, and at very oblique Angles to the ſtream, on purpoſe to ſtop them, and throw them on ſhore neer the Mines.

Thoſe

Thoſe Mines coſt the *Emperour* heretofore 70000. or 80000. *Florens* yearly, and yeilded leſs *Mercury* then at preſent, although it coſts him but 28000. *Florens* now. You may ſee what his Imperial Majeſty gets by the following account, of what *Mercury* the Mines of *Idria* have produced theſe laſt three years.

1661	*l.*
Ordinary *Mercury*	198481
Virgin *Mercury*	6194
	204675

1662.	*l.*
Ordinary *Mercury*	225066
Virgin *Mercury*	9612
	234678

1663	*l.*
Ordinary *Mercury*	244119
Virgin *Mercury*	11862
	255981

There are alwaies at work 280 perſons, according to the relation I received from a very civil perſon, who informed me alſo of all the other particulars above-mentioned, whoſe name is *Achatio Kappenjager*; his Office, *Contra-ſcrivano per ſua Maeſtà Ceſarea in Idria del Mercurio.*

To give ſome light to this Narrative, take this Diagramme: *F.* is the water, *C. B.* a veſſel, into which it runs. *DG. EH. FI.* are ſtreams, perpetually iſſuing from that veſſel: *D. E. F.* three ſives, the diſtance of whoſe wires at bottom leſſen proportionably. *G.* the place, wherein the Earth, that paſs'd through the five *D.* is retained; from whence 'tis taken by the ſecond man; and what paſſes through the five *E.* is retained in *H.* and ſo of the reſt. *K. L. M.* waſt water, which is ſo much impregnated with *Mercury*, that it cureth Itches and ſordid Ulcers. See Fig. 1.

I will treſpaſs a little more upon you, in deſcribing the contrivance of blowing the Fire in the *Braſsworks* of *Tivoli* neer *Rome* (it being new to me) where the Water blows the Fire, not by moving the Bellows, (which is common) but by affording the Wind. See Fig. II. where *A.* is the

River, *B.* the Fall of it, *C.* the Tub into which it falls, *LG.* a Pipe, *G.* the orifice of the Pipe, or Noſe of the Bellows, *GK.* the Hearth, *E.* a hole in the Pipe, *F.* a ſtopper to that hole, *D.* a place under ground, by which the water runns away. Stopping the hole *E*, there is a perpetual ſtrong wind, iſſuing forth at *G*: and *G.* being ſtopt, the wind comes out ſo vehemently at *E*, that it will, I believe, make a Ball play, like that at *Freſcati.*

An Extract of a Letter, containing ſome Obſervations, made in the ordering of Silk-worms, *communicated by that known* Vertuoſo, *Mr.* Dudley Palmer, *from the ingenuous Mr.* Edward Digges.

I herewith offer to your *Society* a ſmall parcel of my *Virginian* ſilk. What I have obſerved in the ordering of Silk-worms, contrary to the received opinion, is:

1. That I have kept leaves 24. hours after they are gathered, and flung water upon them to keep them from withering; yet when (without wiping the leaves) I fed the worms, I obſerved, they did as well as thoſe freſh gathered.

2. I never obſerved, that the ſmell of *Tobacco*, or ſmels that are rank, did any waies annoy the worm.

3. Our Country of *Virginia* is very much ſubject to Thunders: and it hath thundered exceedingly when I have had worms of all ſorts, ſome newly hatched; ſome half way in their feeding; others ſpinning their Silk; yet I found none of them concern'd in the Thunder, but kept to their buſineſs, as if there had been no ſuch thing.

4. I have made many bottoms of the Brooms (wherein hundreds of worms ſpun) of *Holly*; and the prickles were ſo far from hurting them, that even from thoſe prickles they firſt began to make their bottoms.

I did hope with this to have given you aſſurance, that by retarding the hatching of ſeed, two crops of Silk or more might

might be made in a Summer : but my ſervants have been remiſs in what was ordered, I muſt crave your patience till next year.

An Account of Micrographia, *or the* Phyſiological Deſcriptions *of* Minute Bodies, *made by* Magnifying Glaſſes.

The Ingenious and knowing Author of this *Treatiſe*, Mr. *Robert Hook*, conſidering with himſelf, of what importance a faithful *Hiſtory of Nature* is to the eſtabliſhing of a ſolid Syſteme of *Natural Philoſophy*, and what advantage *Experimental* and *Mechanical* knowledge hath over the Philoſophy of *diſcourſe* and *diſputation*, and making it, upon that account, his conſtant buſineſs to bring into that vaſt Treaſury what portion he can, hath lately publiſhed a Specimen of his abilities in this kind of ſtudy, which certainly is very welcome to the Learned and Inquiſitive world, both for the *New diſcoveries* in *Nature*, and the *New Inventions* of *Art*.

As to the *former*, the Attentive Reader of this Book will find, that there being hardly any thing ſo ſmall, as by the help of *Microſcopes*, to eſcape our enquiry, a new viſible world is diſcovered by this means, and the Earth ſhews quite a new thing to us, ſo that in every *little particle* of its matter, we may now behold almoſt as great a variety of creatures, as we were able before to reckon up in the whole *Univerſe* it ſelf. Here our Author maketh it not improbable, but that, by theſe helps the ſubtilty of the compoſition of Bodies, the ſtructure of their parts, the various texture of their matter, the inſtruments and manner of their inward motions, and all the other appearances of things, may be more fully diſcovered; whence may emerge many admirable advantages towards the enlargement of the *Active* and *Mechanick* part of knowledge, becauſe we may perhaps be enabled to diſcern the ſecret

workings of *Nature*, almoſt in the ſame manner, as we do thoſe that are the productions of *Art*, and are managed by *Wheels*, and *Engines*, and *Springs*, that were deviſed by Humane wit. To this end, he hath made a very curious *Survey* of all kinds of bodies, beginning with the *Point of a Needle*, and proceeding to the *Microſcopical* view of the *Edges* of *Raſors*, *Fine Lawn*, *Tabby*, *Watered Silks*, *Glaſs-canes*, *Glaſs-drops*, *Fiery Sparks*, *Fantaſtical Colours*, *Metalline Colours*, *the Figures of Sand*, *Gravel in Urine*, *Diamonds in Flints*, *Frozen Figures*, *the Kettering Stone*, *Charcoal*, *Wood and other Bodies petrified*, *the Pores of Cork*, *and of other ſubſtances*, *Vegetables growing on blighted Leaves*, *Blew mould and Muſhroms*, *Sponges*, *and other Fibrous Bodies*, *Sea-weed*, *the Surfaces of ſome Leaves*, *the ſtinging points of a Nettle*, *Cowage*, *the Beard of a wild Oate*, *the ſeed of the Corn-violet*, *as alſo of Tyme*, *Poppy and Purſlane*. He continues to deſcribe *Hair*, *the ſcales of a Soal*, *the ſting of a Bee*, *Feathers* in general, and in particular thoſe of *Peacocks*; *the feet of Flies*; *& other Inſects*; *the Wings and Head of a Fly*; *the Teeth of a Snail*; *the Eggs of Silk-worms*; *the Blue Fly*; *a water Inſect*; *the Tufted Gnat*; *a White Moth*; *the Shepherds-ſpider*; *the Hunting Spider*, *the Ant*; *the wandring Mite*; *the Crab-like inſect*, *the Book-worm*, *the Flea*, *the Louſe*, *Mites*, *Vine-mites*. He concludeth with taking occaſion to diſcourſe of two or three very conſiderable ſubjects, viz. *The inflexion of the Rays of Lights in the Air*; *the Fixt ſtarrs*; *the Moon*.

In repreſenting theſe particulars to the Readers view, the Author hath not only given proof of his ſingular skil in delineating all ſorts of Bodies (he having drawn all the *Schemes* of theſe 60 *Microſcopical* objects with his own hand) & of his extraordinary care of having them ſo curiouſly engraven by the Maſters of that Art; but he hath alſo ſuggeſted in the ſeveral reflexions, made upon theſe Objects, ſuch conjecturs, as are likely to excite and quicken the Philoſophicall heads to very noble contemplations. Here are found inquiries concerning the *Propagation of Light* through differing mediums;

diums; concerning *Gravity*; concerning the *Roundneſs* of Fruits, ſtones, and divers artificial bodies; concerning *Springineſs* and *Tenacity*; concerning the *Original* of *Fountains*; concerning the *diſſolution of Bodies into Liquors*; concerning *Filtration*, and the aſcent of Juices in Vegetables, and the uſe of their *Pores*. Here an attempt is made of ſolving the ſtrange *Phænomena* of *Graſs-drops*; experiments are alleged to prove the *Expanſion* of *Glaſs* by heat, and the *Contraction* of *heated-Glaſs* upon cooling; *Des Cartes* his *Hypotheſis of colours* is examined: the *cauſe of Colours*, moſt likely to the Author, is explained: Reaſons are produced, that *Reflection* is not neceſſary to produce *colours*, nor a *double refraction*: ſome conſiderable *Hypotheſes* are *offered*, for the explication of Light by Motion; for the producing of all colors by Refraction; for reducing all ſorts of colors to two only, *Yellow* and *Blew*; for making the *Air*, a diſſolvent of all *Combuſtible Bodies*: and for the explicating of all the regular figures of *Salt*, where he alleges many notable inſtances of the *Mathematicks* of *Nature*, as having even in thoſe things which we account vile, rude and coorſe, ſhewed abundance of curioſity and excellent *Geometry* and *Mechaniſm*. And here he opens a large field for inquiries, and propoſeth Models for proſecuting them; 1. By making a full collection of all the differing kinds of *Geometricall* figur'd bodies; 2. By getting with them an exact Hiſtory of their places where they are generated or found: 3. By making ſtore of Tryals in Diſſolutions and Coagulations of ſeverall Cryſtallizing Salts: 4. By making trials on metalls, Minerals and ſtones, by diſſolving them in ſeverall *Menſtruums*, and Cryſtallizing them, to ſee what Figures will ariſe from thoſe ſeveral compoſitums: 5. By compounding & coagulating ſeveral Salts together into the ſame maſs, to obſerve the Figure of that product: 6. By inquiring the cloſenes or rarity of the texture of thoſe bodies, by examining their gravity, and their refraction, &c. 7. By examining what operations the fire hath upon ſeveral kinds of Salts, what changes it cauſes in their figures, Textures, or

Vertues

Vertues. 8. By examining their manner of diſſolution, or acting upon thoſe bodies diſſoluble in them; and the Texture of thoſe bodies before and after the proceſs. 9. By conſidering, by what and how many means, ſuch and ſuch figures, actions and effects could be produced, and which of them might be the moſt likely, &c.

He goes on to offer his thoughts about the Pores of bodies, and a *kind* of *Valves* in wood; about ſpontaneous generation ariſing from the Putrefaction of bodies; about the nature of the Vegetation of mold, muſhromes, moſs, ſpunges; to the laſt of which he ſcarce finds any Body like it in texture. He adds, from the naturall contrivance, that is found in the leaf of a Nettle, how the ſtinging pain is created, and thence takes occaſion to diſcourſe of the poyſoning of Darts. He ſubjoyns a curious deſcription of the ſhape, *Mechaniſm* and uſe of the *ſting* of a *Bee*; and ſhews the admirable Providence of Nature in the contrivance and fabrick of *Feathers* for Flying. He delivers thoſe particulars about the Figure, parts and uſe of the head, feet, and wings of a Fly, that are not common. He obſerves the various wayes of the generations of Inſects, and diſcourſes handſomely of the means, by which they ſeem to act ſo prudently. He taketh notice of the *Mechanical* reaſon of the *Spider's* Fabrick, and maketh pretty Obſervations on the hunting Spider, and other Spiders and their Webs. And what he notes of a Flea, Louſe, Mites, and Vinegar-worms, cannot but exceedingly pleaſe the curious Reader.

Having diſpatched theſe Matters, the Author offers his Thoughts for the explicating of many *Phænomena* of the Air, from the *Inflexion*, or from a *Multiplicate Refraction* of the rays of Light within the Body of the *Atmoſphere*, and not from a *Refraction* cauſed by any terminating *ſuperficies* of the Air above, nor from any ſuch exactly defin'd *ſuperficies* within the body of the *Atmoſphere*: which concluſion he grounds upon this, that a *medium*, whoſe parts are unequally *denſe*, and mov'd by various motions and tranſpoſitions as to one another, will produce all theſe viſible

visible effects upon the rays of Light, without any other *coefficient* cause: and then, that there is in the Air or *Atmosphere*, *such* a variety in the constituent parts of it, both as to their *density* and *rarity*, and as to their divers mutations and positions one to another.

He concludeth with two *Celestial Observations*; whereof the *one* imports, what multitudes of Stars are discoverable by the *Telescope*, and the variety of their magnitudes: intimating with all, that the longer the Glasses are, and the bigger apertures they will indure, the more fit they are for these discoveries: the *other* affords a description of a *Vale* in the *Moon*, compared with that of *Hevelius* and *Ricciolo*; where the Reader will find several curious and pleasant Annotations, about the Pits of the *Moon*, and the Hills and Coverings of the same; as also about the variations in the *Moon*, and its *gravitating* principle, together with the use, that may be made of this Instance of a gravity in the *Moon*.

As to the *Inventions of Art*, described in this Book, the curious Reader will there find these following:

1. A *Baroscope*, or an Instrument to shew all the Minute Variations in the *Pressure of the Air*; by which he affirms, that he finds, that before and during the time of rainy weather, the Pressure of the Air is less; and in dry weather, but especially when an *Easterly* Wind (which having past over vast Tracts of Land, is heavy with earthy particles) blows, it is much more, though these changes be varied according to very odd Laws.

2. A *Hygroscope*, or an Instrument, whereby the *Watery steams*, volatile in the Air, are discerned, which the Nose it self is not able to find. Which is by him fully described in the Observation touching the *Beard of a wild Oate*, by the means whereof this Instrument is contrived.

3. An Instrument for *graduating Thermometers*, to make them *Standards* of *Heat* and *Cold*.

4. A *New Engin* for *Grinding Optick Glasses*, by means of which he hopes, that any Spherical Glasses, of what length soever,

ſoever, may be ſpeedily made: which ſeems to him moſt eaſie, becauſe, if it ſucceeds, with one and the ſame Tool may be ground an *Object Glaſs* of any length or breadth requiſite, and that with very little or no trouble in fitting the *Engin*, and without much skill in the *Grinder*. He thinks it very exact, becauſe to the very laſt ſtroke the Glaſs does regulate and rectifie the *Tool* to its exact Figure; and the longer or more the *Tool* and *Glaſs* are wrought together, the more exact will both of them be of the deſired Figure. He affirms further, that the motions of the Glaſs and Tool do ſo croſs each other, that there is not one point of eithers ſurface, but hath thouſands of croſs motions thwarting it, ſo that there can be no kind of *Rings* or *Gutters* made, either in the *Tool* or *Glaſs*.

5. A *New Inſtrument*, by which the *Refraction* of all kinds of Liquors may be exactly meaſured, thereby to give the Curious an opportunity of making Trials of that kind, to eſtabliſh the *Laws* of *Refraction*, to wit, whether the *Sines of the Angles of Refraction are reſpectively proportionable to the Sines of the Angles of Incidence:* This Inſtrument being very proper to examine very accurately, and with little trouble, and in ſmall quantities, the *Refraction* of any Liquor, not onely for *one* inclination, but for *all*; whereby he is enabled to make accurate *Tables*. By the ſame alſo he affirms to have found it true, that what *proportion* the *Sine* of the Angle of the one *inclination* has to the *Sine* of its Angle of *Refraction*, correſpondent to it, the ſame proportion have all the other *Sines* of Inclination to their reſpective *Sines* of *Refractions*.

Laſtly, this Author deſpairs not that there may be found many Mechanical Inventions, to improve our Senſes of *Hearing*, *Smelling*, *Taſting*, *Touching*, as well as we have improved that of *Seeing* by *Optick Glaſſes*.

London, Printed with Licence for *John Martyn*, and *James Alleſtry*, Printers to the *Royal Society*.

PHILOSOPHICAL TRANSACTIONS.

Munday, May 8. 1665.

The Contents.

Some Obſervations and Experiments upon May-Dew. *The Motion of the* Second Comet *predicted, by the ſame perſon, who predicted that of the former. A Relation of the Advice, given by a* French *Gentleman, touching the Conjunction of the* Ocean *and the* Mediterranean. *Of the way of killing* Ratle-ſnakes, *uſed in* Virginia. *A Relation of Perſons kill'd with Subterraneous* Damps. *Of the* Mineral *of* Liege, *yielding both* Brimſtone, *and* Vitriol, *and the way of extracting them out of it, uſed at* Liege. *An Account of Mr.* Boyle's *Experimental* Hiſtory *of* Cold.

Some Obſervations and Experiments upon May-Dew.

THAT ingenious and inquiſitive Gentleman, Maſter *Thomas Henſhaw*, having had occaſion to make uſe of a great quantity of *May-dew*, did, by ſeveral caſual Eſſayes on that Subject, make the following Obſervations and Tryals, and preſent them to the *Royal Society*.

That *Dew* newly gathered and filtred through a clean Linnen cloth, though it be not very clear, is of a yellowiſh Colour, ſomewhat approaching to that of Urine.

That having endevoured to putrefy it by putting ſeveral proportions into Glaſs bodies with blind heads, and ſetting them in ſeveral heats, as of dung, and gentle baths, he quite failed of his intention: for heat, though never ſo gentle, did rather clarify, and preſerve it ſweet, though continued for two months together, then cauſe any putrefaction or ſeparation of parts.

That expoſing of it to the Sun for a whole Summer in Glaſſes, that hold about two Gallons, with narrow mouths, that might be ſtopp'd with Cork, the only conſiderable alteration, he obſerved to be produced in it, was, that Store of green ſtuff (ſuch as is ſeen in Summer in ditches and ſtanding waters) floated on the top, and, in ſome places, grew to the ſides of the Glaſs.

That putting four or five Gallons of it into a half Tub, as they call it, of Wood, and ſtraining a Canvas over it, to keep out Duſt and Inſects, and letting it ſtand in ſome ſhady room for three weeks or a month, it did of it ſelf putrefy and ſtink exceedingly, and let fall to the bottom a black ſediment like Mudd.

That, coming often to ſee, what Alterations appeared in the putrefaction, He obſerved, that at the beginning, within twenty four hours, a ſlimy film floated on the top of the water, which after a while falling to the bottom, there came another ſuch film in its place.

That if *Dew* were put into a long narrow Veſſel of Glaſs, ſuch as formerly were uſed for Receivers in diſtilling of *Aqua Fortis*, the ſlime would riſe to that height, that He could take it off with a Spoon; and when he had put a pretty quantity of it into a drinking Glaſs, and that it had ſtood all night, and the water dreined from it, if He had turned it out of his hand, it would ſtand upright in figure of the Glaſs, in ſubſtance like boyled white Starch, though ſomething more tranſparent, if his memory (*ſaith he*) fail him not.

That having once gotten a pretty quantity of this gelly, and put it into a Glaſs-body and Blind-head, He ſet it into a gentle

Bath;

Bath, with an intention to have putrefied it, but after a few days He found, the head had not been well luted on, and that ſome moiſture exhaling, the gelly was grown almoſt dry, and a large *Muſhrom* grown out of it within the Glaſs. It was of a looſe watriſh contexture, ſuch an one, as he had ſeen growing out of rotten wood.

That having ſeveral Tubs with good quantity of *Dew* in them, ſet to putrefy in the manner aboveſaid, and coming to pour out of one of them to make uſe of it, He found in the water a great bunch, bigger then his fiſt, of thoſe Inſects, commonly called *Hog-lice* or *Millepedes*, tangled together by their long tailes, one of which came out of every one of their bodies, about the bigneſs of a Horſehair: The Inſects did all live and move, after they were taken out.

That emptying another Tub, whereon the Sun, it ſeems, had uſed ſometimes to ſhine, and finding, upon the ſtraining it through a clean linnen cloth, two or three ſpoonfulls of green ſtuff, though not ſo thick nor ſo green as that above mentioned, found in the Glaſſes *purpoſely* expoſed to the Sun, He put this green ſtuff in a Glaſs, and tyed a paper over it, and coming ſome dayes after to view it, He found the Glaſs almoſt filled with an innumerable Company of ſmall Flyes, almoſt all wings, ſuch as are uſually ſeen in great Swarms in the Aire in Summer Evenings.

That ſetting about a Gallon of this *Dew* (which, he ſaith, if he miſremember not, had been firſt putrefied and ſtrained) in an open Jarre-Glaſs with a wide mouth, and leaving it for many weeks ſtanding in a South-window, on which the Sun lay very much, but the Caſements were kept cloſe ſhut; after ſome time coming to take account of his *Dew*, He found it very full of little Inſects with great Heads and ſmall tapering Bodies, ſomewhat reſembling Tadpoles, but very much leſs. Theſe, on his approach to the Glaſs, would ſink down to the bottom, as it were to hide themſelves, and upon his retreat wriggle themſelves up to the top of the water again. Leaving it thus for ſome time longer, He afterwards found the room very full of Gnats, though the Door and Windows were kept ſhut. He adds, that He did not at firſt ſuſpect, that thoſe Gnats had any

relation to the *Dew*, but after finding the Gnats to be multiplied and the little watry Animals to be much leſſened in quantity, and finding great numbers of their empty skins floating on the face of his *Dew*, He thought, he had juſt reaſon to perſwade himſelf, the Gnats were by a ſecond Birth produced of thoſe little Animals.

That vapouring away great quantities of his putrefied *Dew* in Glaſs Baſons, and other Earthen glaſed Veſſels, He did at laſt obtain, as he remembers, above two pound of *Grayiſh Earth*, which when he had waſhed with more of the ſame *Dew* out of all his Baſons into one, and vapoured to ſiccity, lay in leaves one above another, not unlike to ſome kind of brown Paper, but very friable.

That taking this Earth out, and after he had well ground it on a Marble, and given it a ſmart Fire, in a coated Retort of Glaſs, it ſoon melted and became a Cake in the bottom, when it was cold, and looked as if it had been Salt and Brimſtone in a certain proportion melted together; but, as he remembers, was not at all inflamable. This ground again on a Marble, *he ſaith*, did turn Spring water of a reddiſh purple Colour.

That by often calcining and filtring this Earth, He did at laſt extract about two ounces of a fine ſmall *white Salt*, which, look'd on through a good *Microſcope*, ſeemed to have Sides and Angles in the ſame number and figure, as *Rochpeeter*.

The Motion of the Second *Comet predicted, by the ſame Gentleman, who predicted that of the* former.

Monſieur *Auzout*, the ſame Perſon, that not long ſince communicated to the World his *Ephemerides* touching the courſe of the former *Comet*, and recommended ſeveral Copies of them to the *Royal Society*, to compare their Obſervations with his Account, and thereby, either to verifie his Predictions, or to ſhew, wherein they differ, hath lately ſent another *Ephemerides* concerning the Motion of the *Second* Comet, to the ſame end, that invited him to ſend the other.

In

In that Tract he obſerves, firſt in *General*, that this ſecond *Comet* is contrary to the precedent, almoſt in all particulas: ſeing that the *former* moved very ſwift, *this*, pretty ſlow; *that*, againſt the Order of the ſigns from Eaſt to Weſt, *this*, following them, from Weſt to Eaſt: *that*, from South to North, *this*, from North to South, as far as it hath been hitherto, that we hear off, obſerved: *that*, on the ſide oppoſite to the Sun, *this*, on the ſame ſide: *that*, having been in its *Perigee* at the time of its Oppoſition, *this*, having been there, out of the time of its Conjunction: where he taketh alſo notice, that this *Comet* differs in brightneſs from the other, as well in its Body, which is far more vivid and diſtinct, as in its *Train*, whoſe ſplendor is much greater, ſince it may be ſeen even with great *Teleſcopes*, which were uſeleſs in the former, by reaſon of its dimneſs. After this he deſcends to particulars, and informs us, that he began to obſerve this Comet *April* the ſecond, and continued for ſome days following, and that as ſoon as he had made three or four Obſervations, he reſolved to try again an *Ephemerides*; but that, having no inſtruments exact enough, and the Comet being in a place, deſtitute of Stars, and ſubject to Refractions, he feared to venture too much upon Obſervations ſo neer one another, ſince in ſuch matters a perfect exactneſs is neceſſary, and wiſhed to ſee ſome precedent Obſervations to direct him: which having obtained, he thereby verified what he had begun, and reſolved to carry on his intended *Ephemerides*, eſpecially being urged by his Friends, and engaged by his former undertaking, that ſo it might not be thought a meer hazard, that made him hit in the former; as alſo, that he might try, whether his Method would ſucceed as well in ſlower, as in ſwifter Comets, and in thoſe, that are neer the Sun; as in ſuch as are oppoſite thereunto, to the end, that men might be advertiſed of the *determination* of its uſe, if it could not ſerve but in certain particular Caſes.

He relateth therefore, that he had finiſh'd this New *Ephemerides April* the ſixth, and put it preſently to the Preſs; in doing of which, he hopes, he hath not diſobliged the Publick: ſeeing that, though we ſhould looſe the ſight of this Star within a few days, by reaſon of its approach to the Sun, yet having found,

that

that it is always to riſe before the Sun, and that we may again ſee it better, when it ſhall riſe betimes, towards the end of *May*, and in the beginning of *June*, if the cleerneſs of the Day-break hinder us not; he thought it worth the while to try, whether the truth of this *Ephemerides* could be proved.

He affirms then, that the *Line* deſcribed by this Star reſembles hitherto a *Great Circle*, as it is found in all other Comets in the midſt of their Courſe. He finds the ſaid Circle inclined to the *Ecliptique* about 26. *d.* 30'. and the *Nodes*, where it cuts it, towards the beginning of *Gemini* and *Sagittary*: that it declines from the *Equator* about 26. *d.* and cuts it towards the 11. *d.* and conſequently, that its greateſt *Latitude* hath been towards *Piſces*, where it muſt have been *March* 24. and its greateſt *Declination*, towards the 25. *d*, of the *Equator*, where it was to have been *April* 11.

He puts it in its *Perigee March* 27. about three of the Clock in the Afternoon, when it was about the 15. degrees of *Piſces*, a little more *Weſterly* then *Marchab*, or the *Wing* of *Pegaſus*, and that it was to be in *Conjunction* with the *Sun*, *April* 9. Where yet he noteth, that according to another Calculation, the *Perigee* was *March* 27. more towards Night, ſo that the Comet advances a little more towards the *Eaſt*, and retards towards the *Weſt*; which not being very ſenſible in the firſt days, differs more about the end, and in the beginning; which he leaves to Obſervation.

He calculateth, that the greateſt Motion it could make in one day, hath been 4. d. and 8'. or 9'; in one hour, about 10'. and 25". ſo that its *Diurnal Motion* is to its leſt diſtance from the Earth a little more than as 1. to 14. and its *Hourly Motion*, as 1. to 330.

He wonders, that it hath not been ſeen ſooner; the firſt Obſervations that he hath ſeen, but made by others, being of *March* 17. Whereas he finds, that it might have been ſeen ſince *January*, at leaſt in the Months of *February* and *March*, when it roſe at 2 of the Clock and before: becauſe it is very likely, that, conſidering its bigneſs and brightneſs, when it was towards its *Perigee*, it was viſible, ſince that towards the end of *February* it was not three times as much remote from the Earth, than when it was in its *Perigee*, and that towards the end of *January* it was not five times as much.

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In the interim, *ſaith he*, the other *Comet* could be ſeen with the naked eye until *January* 31. when it was more than ten times further remote, than in its *Perigee*, although it was not by far ſo bright, nor its ſtreamer ſhining as this hath appeared.

He wiſhes, that all the changes that ſhall fall out in this *Comet*, might be exactly obſerv'd; becauſe of its not being ſwift, and the Motion of the Earth very ſenſible, unleſs the *Comet* be extreamly remote, we ſhould find much more light from this, than the former Star, about the Grand Queſtion, whether the *Earth* moves or not: this Author having all along entertained himſelf with the hopes, that the Motion of *Comets* would evince, whether the *Earth* did move or not; and this very *Comet* ſeemed to him to have by deſign appeared for that end, if it had had more *Latitude*, and that conſequently we might have ſeen it before Day-break. He wiſhes alſo, that, if poſſible, it may be accurately obſerved, whether it will not a little decline from its great Circle towards the *South*; Judging, that ſome important truth may be thence deduced, as well as if its motion retarded more, than the place of its *Perigee* (which will be more exactly known when all the paſſed Obſervations ſhall have been obtained) and its greateſt Motion doe require.

He fears only, that it being then to riſe at Break of Day, exact Obſervations cannot be made of it: but he would, at leaſt have it ſought with *Teleſcopes*, his *Ephemerides* directing whereabout it is to be.

April 10. it was to be over againſt the point of the *Triangle*, and from thence more *Southerly* by more than two degrees; and *April* 11. over againſt the bright Star of *Aries*: *April* 17. over againſt the Stars of the *Fly*, a little more *Southerly*, and *May* 4. it is to be over againſt the *Pleiades*, and about the fourth or fifth of the ſame Month, it is to be once more in *Conjunction* with the *Sun*; after which time, the *Sun* will move from it *Eaſtward*, and leave it towards the *Weſt*; which will enable us to ſee it again at a better hour, provided the cleerneſs of the Day-break be no impediment to us. He addeth, that this Star muſt have been the third time in *Conjunction* with the *Sun*, about the time when it firſt began to appear: and foreſees, that from all theſe particulars many conſiderable conſequences may be deduced.

It will cut the *Ecliptick* about the end of *July*, new Style, a little more *Eaſtwards* than the *Eye* of *Taurus*: at which time there will be no ſeeing of it, except it be with a *Teleſcope*.

It will be towards the *End* of *April*, new ſtyle, twice as far diſtant as it was in its *Perigee*, thrice as far, *May* the fourth, four times, *May* the eighteenth, and five times, *June* the firſt, *&c.*

He would not have Men ſurpriſed, that there have been two *Comets* within ſo ſhort a time; ſeeing, *ſaith he*, there were four, at leaſt, three, in the Year 1618. and in other Years there have been two and more at the ſame time. What he adds about their ſignification, we leave to *Aſtrologers* to diſpute it with him. He concludeth with asking pardon, if he have committed miſtakes, which he hopeth he ſhall obtain the ſooner, becauſe of the ſmall time he hath had for theſe calculations: and he wiſhes that he could have made all the Obſervations himſelf, ſeeing that it is eaſie to fail, when one muſt truſt to the Obſervations of others, whereof we know not the exactneſs: where he inſtanceth, that, according to his Obſervations, the way of the *Comet* ſhould go neerer the Ecliptick than he hath marked it, even without having any great regard to the Refractions: but ſince he would ſubject himſelf to others, he hath made it paſs a little higher, which, he ſaith, was almoſt inſenſibly ſo, in thoſe few days that he was obſerving and writing, but that this may perhaps become ſenſible hereafter: which if it be ſo, he affirms that it will cut the *Ecliptick* and *Equator* ſooner, than he hath marked it, *&c.* However, he thinks it convenient, to have given aforehand a common Notion of what will become of a *Comet*, to prepare men for all the Changes that may fall out concerning it: which he affirms he hath endeavoured to do; the reſt being eaſie to correct, as ſoon as any good Obſervations, ſomewhat diſtant, have been obtained, conſidering, that there need but two very exact ones, a little diſtant when the Star is not ſwift, to trace its Way; although there muſt be at leaſt three, to find out all the reſt. But, then would he have it conſidered, that although his Method ſhould be very exact, if there be not at hand Inſtruments big enough, and Globes good enough to truſt to, nothing can be done perfectly in theſe kind of Predictions.

A Relation

A Relation of the advice give nby Monſieur Petit, Intendant of the Fortifications of Normandy. touching the Conjunction of the Ocean and Mediterranean.

This Intelligent Gentleman, Monſieur *Petit*, having been conſulted with, touching the Conjunction of the *Ocean* and *Mediterranean*, delivers firſt the Propoſition, and then giveth his thoughts upon it.

The Propoſition is, That there being about two Leagues below *Caſtres* in *Languedoc* a Rivolet, called *Sor*, paſſing to *Revel*, there may by the means thereof be made a Communication of the two Seas, by joyning the Waters of this Rivolet by a Channel (to be kept full all the year long) With thoſe of St. *Papoul*, and others, which fall into *Freſqueil* (another ſmall River) that runs into the *Aude* below *Carcaſſone*, and go together to *Narbonne*, ſituated upon the *Mediterranean*.

Having given the Propoſition, he adds ſome particulars, to illuſtrate the ſame, before he declares his judgment upon it. For he relateth, that there is but one way, after the diviſion of the Waters, to paſs to the *Mediterranean*, which is by a Rivolet, called *Freſqueil*, that is conjoyn'd with the *Aude*: But, to paſs to the *Ocean*, there are three; One, by *Riege*, entring into the *Garonne* above *Tholouſe*; the other, by *Lers*, paſſing on the ſide, and below the ſame Town; and the third, by *Sor*, falling into the River *Agouſt* under *Caſtres*, afterwards into the *Tarne*, and thence to *Montauban*, and laſtly into the *Garonne*. And that, to compaſs this deſign, all theſe Rivers and Rivolets are firſt to be made Navigable unto their *Sluces*; that of *Aude* and *Freſqueil* for the *Mediterranean*, and one of the others, ſuch as ſhall be choſen, for the *Ocean*. He addeth, that, as to the ſeveral Ways paſſing to the *Ocean*, all of them commended as proper and convenient, and the three Countries concerned therein, ſpeaking every one for their advantage: Thoſe of *Caſtres* and

Montauban, are for the River *Agouſt*; thoſe of *Tholouſe*, for *Riege*; and the reſt, for *Lers*.

Now concerning his Opinion upon this Propoſition, he thinks, that all that hath been repreſented touching this matter, can ſignify very little, ſeeing that the main thing is wanting, which is the aſſurance, and certain and poſitive menſuration of the height and quantity of the Waters, neceſſary to fall into both the Channels of the *Aude* and *Garonne*: that there muſt be plenty of that, to furniſh at all times and alwaies the higheſt and firſt *Sluces*, ſince what once iſſues thence, doth never enter again into them; and after ſome Boats are paſſed, if there ſhould not be a ſufficient ſupply for thoſe that come after, either to go up, or to go down, all would ſtand dry, and Merchants and their Commodities would ſtay long enough expecting the ſupply of Rains, to their great detriment. He concludeth therefore, that no knowing and diſcreet Perſon is able, in matters of this nature, to give a poſitive anſwer, without having before him a large and exact Topographical Map of thoſe places, and of the ſources of all the Rivolets, that are to ſupply the Water to the Head of the pretended Channel, together with a full account of the ſurvey and menſuration of all the places, through which it is to paſs; of the Nature of the Ground, whether it be ſtony, ſandy, rocky, *&c.* of the exact level of all the places, where it is to be made, and of the ſeveral riſings and depreſſions thereof, to be aſſured that the Water may be conveyed to the greateſt riſing, and to the higheſt *Sluce*; and laſtly, of the quantity, that may be had at high, middle, and low Water, to have enough for all times; that all theſe things being firſt made out, 'tis then time enough to judge of the poſſibility of the thing, and to calculate the Charges neceſſary for Execution.

This Artiſt having thus prudently waved this Propoſition, diverts himſelf with reflecting upon ſeveral others of the like nature, among which he inſiſts chiefly upon two, whereof one is that ſo much celebrated in *Egypt*,; the other, of *Germany*. And he is of Opinion, that the moſt important of all is that, of conjoyning the *Red ſea* by the *Nile* with the *Mediterranean*, which he looks upon as the moſt excellent conveniency to go into the *Eaſt-Indies* without doubling the *Cape* of *Good-Hope*; and yet it could

could not be executed by thoſe great Kings of *Egypt*, that raiſed ſo many ſtupendious *Pyramids*; although in his Opinion the reaſons alleged by *Hiſtorians* to juſtifie them for having abandoned that undertaking, are of no validity, and that the *Red Sea* cannot be, as they feared, higher than the *Nile*, and therefore not indanger the inundation of *Egypt*.

The other Propoſition was made to *Charles Magne*, *Anno* 793. for joyning the *Euxine* Sea and the *Ocean* together, by a Channel, which was begun for that end, and deſigned to be 2000. paces long, and 100. paces broad, betwixt the River *Altmull*, falling into the *Danube* above *Ratisbone*, and the River *Rott*, paſſing at *Nurenberg*, and thence running into the *Main*, and ſo into the *Rhine*. But yet this alſo proved abortive, though there was great appearance of ſucceſs at firſt.

Of the Way of killing Ratle-Snakes.

There being not long ſince occaſion given at a meeting of the *Royal Society* to diſcourſe of *Ratle-Snakes*, that worthy and inquiſitive Gentleman, Captain *Silas Taylor*, related the manner, how they were killed in *Virginia*, which he afterwards was pleaſed to give in writing, atteſted by two credible perſons in whoſe preſence it was don; which is, as follows.

The Wild *Penny-royal* or *Ditany* of *Virginia*, groweth ſtreight up about one foot high, with the leaves like *Penny-royal*, with little blue tufts at the joyning of the branches to the Plant, the colour of the Leaves being a reddiſh green, but the Water diſtilled, of the colour of Brandy, of a fair Yellow: the Leaves of it bruiſed are very hot and biting upon the Tongue: and of theſe, ſo bruiſed, they took ſome, and having tyed them in the cleft of a long ſtick, they held them to the Noſe of the *Ratle-Snake*, who by turning and wriggling laboured as much as ſhe could to avoid it: but ſhe was killed with it, in leſs than half an hour's time, and, as was ſuppoſed, by the ſcent thereof; which was done *Anno* 1657. in the Month of *July*, at which ſeaſon, they repute thoſe creatures to be in the greateſt vigour for their poiſon.

A Relation of Persons killed with subterraneous Damps.

This Relation was likewise made to the *Royal Society*, by that Eminent *Virtuoso* Sir *R. Moray*, who was pleased, upon their desire, to give it them in writing; as followeth,

In a Coal-pit, belonging to the Lord *Sinclair* in *Scotland*, where the Coal is some 18 or 20 foot thick, and antiently wasted to a great depth: The Colliers, some Weeks agoe, having wrought as deep as they could, and being to remove into new Rooms (as they call them) did, by taking off, as they retired, part of the Coal that was left as Pillars to support the Roof and Earth over it, so much weaken them, that within a short space, after they were gone out of the Pitt, the Pillars falling, the Earth above them filled up the whole Space, where the Colliers had lately wrought, with its ruins. The Colliers being here-by out of work, some of them adventured to work upon old remains of Walls, so near the old wastes, that striking through the slender partition of the Coal wall, that separated between them and the place, where they used to work, they quickly perceived their Errour, and fearing to be stifled by the bad Air, that they knew, possessed these old wastes, in regard not onely of the Damps, which such wastes do usually afford, but because there having for many years been a Fire in those wastes, that filled them with stifling fumes and vapours, retired immediately and saved themselves from the eruptions of the Damp. But next day some seven or eight of them came no sooner so farr down the staires, that led them to the place, where they had been the day before, as they intended, but upon their stepping into the place, where the Air was infected, they fell down dead, as if they had been shott: And there being amongst them one, whose Wife was informed he was stifled in that place, she went down so far without inconvenience, that seeing her Husband near her, ventured to go to him, but being choaked by the Damp, as soon as she came near him, she fell down dead by him.

This

This Story Sir *R. Moray* affirmed to have received from the *Earl* of *Weymes*, Brother in Law to the Lord *Sinclair*, as it was written to him from *Scotland*.

Of the Mineral *of* Liege, *yielding both* Brimſtone *and* Vitriol, *and the way of extracting them out of it, uſed at* Liege.

The Account of this *Mineral*, and of the way of extracting both *Brimſtone* and *Vitriol* out of it, was procured from *Liege*, by the lately mentioned Sir *Robert Moray*, and by him communicated to the *Royal Society*, as follows.

The *Mineral*, out of which *Brimſtone* and *Vitriol* are extracted, is one and the ſame, not much unlike Lead-ore, having alſo oft times much Lead mingled with it, which is ſeparated from it by picking it out of the reſt. The Mines reſemble our *Engliſh* Coal-Mines, dugg according to the depth of the *Mineral*, 15, 20, or more fathoms, as the Vein leads the Workmen, or the ſubterranean waters will give them leave, which in Summer ſo overflow the Mines, that the upper waters, by reaſon of the drought, not ſufficing to make the Pumps goe, the Work ceaſes.

To make *Brimſtone*, they break the Stone or Ore into ſmall pieces, which they put into Crucibles made of Earth, five foot long, ſquare and Pyramid-wiſe. The Entry is near a foot ſquare. Theſe Crucibles are laid ſloaping, eight undermoſt, and ſeven above them, as it were betwixt them, that the Fire may come at them all, each having its particular Furnace or Oven. The *Brimſtone* being diſſolved by the violence of the heat, drops out at the ſmall end of the Crucible, and falls into a Leaden-Trough or Receptacle, common to all the ſaid Crucibles, through which there runs a continual Rivolet of cold water, conveyed thither by Pipes for the cooling of the diſſolved Sulphur, which is ordinarily four hours in melting. This done, the Aſhes are drawn out with a crooked Iron, and being put into an Iron Wheel-barrow, are carried out of the Hutt, and being

being laid in a heap, are covered with other elixed or drained Aſhes, the better to keep them warm; which is reiterated, as long as they make *Brimſtone*.

To make *Coperas* or *Vitriol*, they take a quantity of the ſaid Aſhes, and throwing them into a ſquare planked pit in the Earth, ſome four foot deep, and eight foot ſquare, they cover the ſame with ordinary water, and let it lye twenty four hours, or untill an Egge will ſwim upon the liquor, which is a ſign, that it is ſtrong enough. When they will boyl this, they let it run through Pipes into the Kettles, adding to it half as much Mother-water, which is that water, that remains after boyling of the hardned *Coperas*. The Kettles are made of Lead, 4 ½ foot high, 6 foot long, and 3 foot broad, ſtanding upon thick Iron Barrs or Grates. In theſe the Liquor is boyled with a ſtrong Coal-fire, twenty four hours or more, according to the ſtrength or weakneſs of the Lee or Water. When it is come to a juſt conſiſtence, the fire is taken away, and the boyled liquor ſuffered to cool ſomewhat, and then it is tapp'd out of the ſaid Kettles, through holes beneath in the ſides of them, and conveyed through wooden Conduits into ſeveral Receptacles, three foot deep and four foot long (made and ranged not unlike our Tan-pits) where it remains fourteen or fifteen dayes, or ſo long till the *Coperas* ſeparate it ſelf from the water, and becomes icy and hard. The remaining water is the above-mentioned Mother-water; and the elixed or drained Aſhes are the Dreggs, or *Caput mortuum*, which the Lee, whereof the *Vitriol* is made, leaves behind it in the planked Pitts.

A further Account of Mr. Boyle's *Experimental* Hiſtory of Cold.

In the firſt Papers of theſe *Philoſophical Tranſactions*, ſome promiſe was made of a *fuller* account, to be given by the next, of the *Experimental Hiſtory of Cold*, compoſed by the Honourable Mr. *Robert Boyle*; it being then ſuppoſed, that this *Hiſtory* would have been altogether printed off at the time of publiſhing the *Second* Papers

Papers of theſe *Tranſactions*; but the Preſs, employed upon this Treatiſe, having been retarded ſomewhat longer than was gheſſed, the ſaid promiſe could not be performed before this time: wherein it now concerns the inquiring World to take notice, that this ſubject, as it hath hitherto bin almoſt totally neglected, ſo it is now, by this Exceellent Author, in ſuch a manner handled, and improved by near *Two hundred* choice *Experiments* and *Obſervations*, that certainly the *Curious* and *Intelligent* Reader will in the peruſal thereof find cauſe to admire both the Fertility of a Subject, ſeemingly ſo barren, and the Author's Abilities of improving the ſame to ſo high a Degree.

But to take a ſhort view of ſome of the particulars of this *Hiſtory*, and thereby to give occaſion to *Philoſophical* men, to take this Subject more into their conſideration, than hitherto hath been done; the Ingenious Readers will here ſee,

1, That not only all ſorts of *Acid* and *Alcalizate* Salts, and Spirits, even Spirit of Wine; but alſo Sugar, and Sugar of Lead mixed with Snow, are capable of freezing other Bodies, and upon what account they are ſo.

2, That among the Subſtances capable of being frozen, there are not only all groſs ſorts of Saline Bodies, but ſuch alſo as are freed from their groſſer parts, not excepting Spirit of Urine, the *Lixivium* of Pot-aſhes, nor Oyl of Tartar, *per deliquium*, it ſelf.

3, That many very ſpirituous liquors, freed from their aqueous parts, cannot be brought to freeze, neither naturally, nor artificially: And here is occaſionally mentioned a way of keeping *Moats* unpaſſable in very cold Countries, recorded by *Olaus Magnus*.

4, What are the wayes proper to eſtimate the greater or leſſer Coldneſs of Bodies; and by what means we can meaſure the intenſneſs of Cold produced by Art, beyond that, which Nature needs to employ for the freezing of Water; as alſo, in what proportion water of a moderate degree of Coldneſs will be

be made to *ſhrink* by Snow and Salt, before it begin by Congelation to *expand* it ſelf; and then, how to meaſure by the differing Weight and Denſity of the ſame portion of Water, what change was produced in it, betwixt the hotteſt time of Summer, and firſt glaciating degree of Cold, and then the higheſt, which our Author could produce by *Art*: Where an Inquiry is annex'd, whether the making of theſe kind of Tryals with the waters of the particular Rivers and Seas, men are to ſail on, may afford any uſeful eſtimate, whether or not, and how much, ſhips may on thoſe waters be ſafely loaden more in Winter, than in Summer. To which is added the way of making exact Diſcoveries of the differing degrees of Coldneſs in differing Regions, by ſuch Thermometers, as are not ſubject to the alterations of the *Atmoſphere's* gravitation, nor to be frozen.

5. Whether in Cold, the diffuſion from Cold Bodies be made more ſtrongly downwards, contrary to that of Hot Bodies: Where is delivered a way of freezing Liquors without danger of breaking the Veſſel, by making them begin to freeze at the bottom, not the top.

6. Whether that Tradition be true, that if frozen Apples or Eggs be thaw'd neer the Fire, they will be thereby ſpoil'd, but if immerſed in cold water, the Internal Cold will be drawn out, as is ſuppoſed, by the External Cold; and the frozen Bodies will be harmleſly thawed? *Item*, Whether Iron, or other Metals, Glaſs, Stone, Cheeſe, *&c.* expos'd to the freezing Air, or kept in Snow or Salt, upon the immerſing them in Water will produce any Ice? *Item*, What uſe may be made of what happens in the different waies of thawing Eggs and Apples, by applying the Obſervation to other Bodies, and even to Men, dangerouſly nipp'd by exceſſive Cold. Where is added not only a memorable Relation, how the whole Body of a Man was ſucceſsfully thawed and caſed all over with Ice, by being handled, as frozen Eggs and Apples are; but alſo the Luciferouſneſs of ſuch Experiments as theſe: and likewiſe, what the effects of Cold may be, as to the Conſervation or Deſtruction of the Textures of Bodies: and in particular, how Meat and Drink

may

may be kept good, in very Cold Countries, by keeping it under Water, without glaciation? as alſo, how in extreme Cold Countries, the Bodies of Dead Men and other Animals may be preſerved very many years entire and unputrefied? And yet, how ſuch Bodies, when unfrozen, will appear quite vitiated by the exceſſive Cold? Where it is further inquired into, whether ſome Plants, and other Medicinal things, that have ſpecifique Vertues, will looſe them by being throughly congealed and (ſeveral wayes) thawed? And alſo, whether frozen and thawed Harts-horn will yield the ſame quantity and ſtrength of Salt and ſaline Spirit, as when unfrozen? *Item*, Whether the *Electrical* faculty of *Amber*, and the *Attractive* or *Directive* Virtue of *Loadſtones* will be either impaired, or any wayes altered by intenſe Cold? This Head is concluded by ſome conſiderable remarks touching the operation of Cold upon Bones, Steel, Braſs, Wood, Bricks.

7, What Bodies are expanded by being frozen, and how that expanſion is evinced? And whether it is cauſed by the intruſion of Air? As alſo, whether, what is contained in icy bubbles, is true and Springy Air, or not.

8, What Bodies they are, that are contracted by Cold; and how that Contraction is evinced? Where 'tis inquired, whether *Chymical Oyles* will, by Congelation, be, like expreſſed Oyles, contracted, or, like aqueous Liquors, expanded?

9, What are the wayes of *Meaſuring* the *Quantity* of the Expanſion and Contraction of Liquors by Cold? And how the Author's account of this matter agrees with what Navigators into cold Climats, mention from experience, touching pieces of Ice as high as the Maſts of their Ships, and yet the Depth of theſe pieces ſeems not at all anſwerable to what it may be ſuppoſed to be.

10, How ſtrong the Expanſion of freezing water is? Where are enumerated the ſeveral ſorts of Veſſels, which being filled

with water, and expoſed to the cold Air, do burſt; and where alſo the weight is expreſſed, that will be removed by the expanſive force of Freezing? Whereunto an Inquiry is ſubjoined, whence the prodigious force, obſerved in water, expanded by Glaciation, ſhould proceed? And whether this *Phænomenon* may be ſolved, either by the *Carteſian*, or *Epicurean* Hypotheſis?

11, What is the *Sphere of Activity* of Cold, or the Space, to whoſe extremities every way the Action of a cold Body is able to reach: where the difficulty of determining theſe limits, together with the cauſes thereof, being with much circumſpection mentioned, it is obſerved, that the *Sphere of Activity* of Cold is exceeding narrow, not onely in compariſon of that of Heat in Fire, but in compariſon of, as it were, the *Atmoſphere* of many odorous Bodies; and even in compariſon of the *Sphere of Activity* of the more vigorous Loadſtones, inſomuch, that the Author hath doubted, whether the Senſe could diſcern a Cold Body, otherwiſe then by immediate Contract. Where ſeveral Experiments are delivered for the examining of this matter, together with a curious relation of the way uſed in *Perſia*, though a very hot Climate, to furniſh their *Conſervatories* with ſolid pieces of Ice of a conſiderable thickneſs: To which is added an Obſervation, how far in Earth and Water the Froſt will pierce downwards, and upon what accounts the deepneſs of the Froſt may vary. After which, the care is inculcated, that muſt be had, in examining, whether Cold may be diffuſed through all *Mediums* indefinitly, not to make the Trials with *Mediums* of two great thickneſs: where it is made to appear, that Cold is able to operate through Metalline Veſſels, which is confirmed by a very pretty Experiment of making *Icy Cups* to drink in; whereof the way is accurately ſet down. Then are related the Trials, whether, or how, Cold will be diffuſed through a *Medium*, that *ſome* would think a *Vacuum*, and which to *others* would ſeem much leſs diſpoſed to aſſiſt the diffuſion of Cold, than Common Air it ſelf. After which follows a curious Experiment, ſhewing whether a Cold Body can operate through

a *Medium* actually hot, and having its heat continually renewed by a fountain of heat.

12, How to eſtimate the ſolidity of the Body of Ice, or how ſtrong is the mutual adheſion of its parts? and whether differing Degrees of Cold may not vary the Degree of the compactneſs of Ice. And our Author having proceeded as far as he was able towards the bringing the ſtrength of Ice to ſome Eſtimate by ſeveral experiments, he communicateth the information, he could get about this matter among the Deſcriptions that are given us of Cold Regions: And then he relateth out of Sea-mens *Journals*, their Obſervations touching the inſipidneſs of reſolved Ice made of Sea-water; and the prodigious bigneſs of it, extending even to the height of two hundred and fourty Foot above water, and the length of above eight Leagues. To which he adds ſome promiſcuous but very notable Obſervations concerning Ice, not ſo readily reducible to the foregoing Heads: *videlicet*, Of the blew Color of Rocky pieces of Ice; and the horrid noiſe made by the breaking of Ice, like that of Thunder and Earthquakes, together with a Conſideration of the Cauſe, whence thoſe loud Ruptures may proceed.

13, How Ice and Snow may be made to laſt long; and what Liquor diſſolves Ice ſooner than others, and in what proportion of quickneſs the ſolutions in the ſeveral Liquors are made, where occaſion is offered to the Author, to examine, whether Motion will impart a heat to Ice? After which, he relates an Experiment of *Heating* a *Cold* Liquor with Ice, made by himſelf in the preſence of a Great and Learned Nobleman, and his Lady, who found the Glaſs wherein the Liquor was, ſo hot that they could not endure to hold it in their Hands. Next, it is examined, whether the effects of Cold do continually depend upon the actual preſence and influence of the manifeſt Efficient Cauſes, as the Light of the Air depends upon the Sun or Fire, or other Luminous Bodies. To this is annexed an Account of the *Italian* way of making *Conſervatories* of Ice and Snow, as the Author had received it from that Ingenious and Polite Gentleman, Maſter *J. Evelyn*.

But

But want of time prohibiting the accompliſhment of the intended account of this Rich Piece: what remains, muſt be referred to the next Occaſion. It ſhall only be intimated for a Concluſion, that the *Author* hath annexed to this *Treatiſe*, an Examen of Maſter *Hobs*'s Doctrine touching *Cold*; wherein the *Grand* Cauſe of *Cold* and its Effects is aſſigned to *Wind*, in ſo much that 'tis affirmed, that almoſt any Ventilation and ſtirring of the Air doth refrigerate.

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PHILOSOPHICAL TRANSACTIONS.

Munday, June 5. 1665.

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A Relation of ſome extraordinary Tydes in the Weſt-Iſles of Scotland, *as it was communicated by Sr.* Robert Moray.

IN that Tract of *Iſles*, on the Weſt of *Scotland*, called by the Inhabitants, the *Long-Iſland*, as being about 100. miles long from *North* to *South*, there is a multitude of ſmall Iſlands, ſituated in a *Fretum*, or *Frith*, that paſſes between the Iſland of *Euſt*, and the *Herris*; amongſt which, there is one called *Berneray*, ſome three miles long, and

more than a mile broad, the length running from *East* to *West*, as the *Frith* lyes. At the *East* end of this *Island*, where I ſtayed ſome 16. or 17. dayes, I *obſerved* a very ſtrange Reciprocation of the Flux and Re-flux of the Sea, and *heard* of another, no leſs remarkable.

Upon the *Weſt* ſide of the *Long Iſland*, the Tides, which came from the *South-weſt*, run along the Coaſt, *Northward*; ſo that during the ordinary courſe of the Tides, the Flood runs *Eaſt* in the *Frith*, where *Berneray* lyes, and the Ebb *Weſt*. And thus the Sea ebbs and flows orderly, ſome 4. days before the *full Moon*, and *change*, and as long after (the ordinary Spring-tides riſing ſome 14. or 15. foot upright, and all the reſt proportionably, as in other places) But afterwards, ſome 4. days before the *Quarter-moons*, and as long after, there is conſtantly a great and ſingular *variation*. For *then*, (a *Southerly* Moon making there the full Sea) the courſe of the Tide being *Eaſtward*, when it begins to flow, which is about $9\frac{1}{2}$ of the Clock, not onely connues ſo till about $3\frac{1}{2}$ in the afternoon, that it be high water, but, after it begins to ebb, the Current runs on ſtill *Eaſtward*, during the whole Ebb; ſo that it runs *Eaſtward* 12 hours together, that is, all day long, from about $9\frac{1}{2}$ in the morning, til about $9\frac{1}{2}$ at night. But then, when the night-Tide begins to flow, the Current turns, and runs *Weſtward* all night, during both Floud & Ebb, for ſome 12. hours more, as it did *Eaſtward* the day before. And thus the Reciprocations continue, one Floud and Ebb, running 12. hours *Eaſtward*, and another twelve hours *Weſtward*, till 4. days before the *New* and *Full* Moon; and then they reſume their ordinary regular courſe as before, running *Eaſt*, during the ſix hours of Floud, and *Weſt*, during the ſix of Ebb. And this I obſerved curiouſly, during my abode upon the place, which was in the Moneth of *Auguſt*, as I remember.

But the Gentleman, to whom the *Iſland* belongs at preſent, and divers of his Brothers and Friends, knowing and diſcreet perſons, and expert in all ſuch parts of Sea-matters, as other *Iſlanders* commonly are, though I ſhrewdly ſuſpected their skill in Tides, when I had not yet ſeen what they told me, and I have now related of theſe irregular Courſes of the Tides, did moſt confidently aſſure me, and ſo did every body I ſpake with about

about it, that there is yet another irregularity in the Tides, which never fails, and is no less extraordinary, than what I have been mentioning: which is, That, whereas between the *Vernal* and *Autumnal Equinoxes*, that is, for six Moneths together, the Course of irregular Tides about the Quartermoons, is, to run all day, that is, twelve hours, as from about $9\frac{1}{2}$ to $9\frac{1}{2}$, $10\frac{1}{4}$ to $10\frac{1}{4}$ *&c. Eastward*, and all night, that is, twelve hours more, *Westward*: during the other six Moneths, from the *Autumnal* to the *Vernal Equinox*, the Current runs all day *Westward*, and all Night *Eastward*.

Of this, though I had not the opportunity to be an Eye-witness, as of the other, yet I do not at all doubt, having received so credible Information of it.

To penetrate into the *Causes* of these strange Reciprocations of the Tides, would require exact descriptions of the Situation, Shape, and Extent of every piece of the adjacent Coasts of *Eust* and *Herris*; the Rocks, Sands, Shelves, Promontorys, Bays, Lakes, Depths, and other Circumstances, which I cannot now set down with any certainty, or accurateness; seeing, they are to be found in no *Map*, neither had I any opportunity to survey them; nor do they now occur to my Memory, as they did some years ago, when upon occasion I ventured to make a *Map* of this whole *Frith* of *Berneray*, which not having copied, I cannot adventure to beat it out again.

Monsieur Auzout's *Judgment touching the Apertures of* Object-Glasses, *and their* Proportions, *in respect of the several* Lengths *of* Telescopes.

This Author, observing in a small *French Tract* lately written by him to a Countryman of his, Monsieur *L' Abbe Charles*; That great *Optick-Glasses* have almost never as great an *Aperture* as the small ones, in proportion to what they Magnifie, and that therefore they must be more dim; takes occasion to inform

the *Reader*, that he hath found, that the *Apertures*, which *Optick-Glaſſes* can bear with diſtinctneſs, are in about a *ſubduplicate proportion* to their *Lengths*; whereof he tells us he intends to give the reaſon and demonſtration in his *Diopticks*, which he is now writing, and intends to finiſh, as ſoon as his Health will permit. In the mean time, he preſents the *Reader* with a *Table* of ſuch *Apertures*; which is here exhibited to the Conſideration of the Ingenious, there being of this *French* Book but one Copy, that is known, in *England*.

A *TABLE* of the *Apertures* of *Object-Glaſſes*.

The Points put to ſome of theſe Numbers denote Fractions.

Lengths of Glaſſes. Feet, Inches.	*For excellent ones.* Inch. Lines.	*For good ones.* Inch. Lines.	*For ordinary ones.* Inch. Lines.	*Lengths of Glaſſes.* Feet. Inches.	*For excellent ones.* Inch. Lines.	*For good ones.* Inch. Lines.	*For ordinary ones.* Inch. Lines.
4	4.	4	3	25	3 4	2 10	2 4.
6	5.	5	4	30	3 8	3 2	2 7
9	7	6	5	35	4 0	3 4.	2 10
1 0	8.	7	6	40	4 3	3 7	3 .
1 6	9	8.	7	45	4 6	3 10	3 2.
2 0	11	10	8	50	4 9	4 0	3 4.
2 6	1 0	11	9	55	5 0	4 3	3 6.
3 0	1 1	1 0	10	60	5 2	4 6	3 8.
3 6	1 2.	1 1	11	65	5 4	4 8	3 10
4 0	1 4	1 2	1 0	70	5 7	4 10	4 .
4 6	1 5	1 3	1 .	75	5 9	5 0	4 2.
5 0	1 6	1 4	1 1.	80	5 11	5 2	4 5
6	1 7.	1 5	1 2	90	6 4	5 6	4 7.
7	1 9	1 6	1 3	100	6 8	5 9	4 10
8	1 10	1 8	1 4	120	7 5	6 5	5 3
9	1 11.	1 9	1 5	150	8 0	7 0	5 11
10	2 1	1 10	1 6	200	9 6	8 0	6 9
12	2 4	2 0	1 8	250	10 6	9 2	7 8.
14	2 6	2 2	1 9.	300	11 6	10 0	8 5
16	2 8	2 4	1 11.	350	12 6.	10 9	9 0
18	2 10	2 6	2 1	400	13 4	11 6	9 8
20	3 0	2 7	2 2.				

Conſiderations of Monſieur Auzout *upon Mr.* Hook's *New Inſtrument for Grinding of* Optick-Glaſſes.

In the above-mentioned *French* Tract, there are, beſides ſeveral other particulars, to be repreſented in due place, contained ſome *Conſiderations* of Monſieur *Auzout* upon Mr. *Hook*'s New *Engine* for grinding *Optick-Glaſſes*. Where he premiſes in *General* his thoughts touching the working of *Great* Optick-Glaſſes, and that by the help of a *Turn lathe*; affirming firſt of all, that not only the *Engin* is to be conſidered for giveing the *Figure*, but the *Matter* alſo, which ought to be brought to greater perfection, than it hath been hitherto. For, he finds it not ſo eaſie (at leaſt, *where he is*) to procure *Great* pieces of Glaſs without *Veins*, and other faults, nor to get ſuch, as are thick enough without *Blebbs*; which, if they be not, they will yield to the preſſure and weight, either when they are fitted to the *Cement*, or wrought.

Secondly, He finds it difficult to work theſe *Great* Glaſſes of the *ſame* thickneſs, which yet is very neceſſary, becauſe, that the leaſt difference in *Figures* ſo little *convex*, can put the *Center* out of the *Midle*, 2 or 3 *Inches*; and if they be wrought in *Moulds*, the length of time, which is required to wear and to ſmooth them, may ſpoil the beſt *Mould*, before they be finiſhed. Beſides, that the ſtrength of Man is ſo limited, that he is unable to work Glaſſes beyond a certain bigneſs, ſo as to finiſh and poliſh them all over ſo well, as *ſmall* Glaſſes; whereas yet, the bigger they are, the more compleat they ought to be: And if any weight or Engine be uſed to ſupply ſtrength, there is then danger of an unequal preſſure, and of wearing away the Engine; In the mean time, the preciſeneſs and delicateneſs is greater,

greater than can eaſily be imagined. Wherefore he could never, having ſome experience of this preciſeneſs, conceive, that a *Turn-lathe*, wherein muſt be two different, and in ſome manner contrary motions, can move with that exactneſs and ſteddineſs, that is required, eſpecially, for any conſiderable length of time.

Having premiſed this, he diſcourſes upon Mr. *Hook* his *Turne*, intimating firſt of all, that he was impatient to know what kind of *Turne* this was, imagining, that it had been tried, and had ſucceeded, as coming from a Society that profeſſeth, they publiſh nothing but what hath been maturely examin'd. But that he was much ſurpriſed when he ſaw the *Micrography* of Mr. *Hook*, and found there, that his *Engine* was publiſhed upon a *meer Theory*, without having made any Experiment, though that might have been made with little charge and great ſpeed; expence of Money and Time being the onely thing, that can excuſe thoſe who in matter of *Engines* impart their inventions to the publick, without having tried them, to excite others to make trial thereof.

Whereupon he propoſes ſome difficulties, to give the *Inventor* occaſion to find a way to remove them. He affirms therefore, that though it be true in the *Theory*, that a *Circle*, whoſe *Plain* is inclined to the *Axis* of the *Sphere* by an *Angle*, whereof half the *Diameter* is the *Sine*, and which touches the *Sphere* in its *Pole*, will touch in all its parts a *ſpherical Surface*, that ſhall turn upon that *Axe*. But that it is true alſo, that that muſt be but a *Mathematical Circle*, and without *Breadth*, and which preciſely touches the Body in its middle: Whereas in the practice, a *Circle* capable to keep Sand and Putty, muſt be of ſome *breadth*; and he knows not whether we can find ſuch a dexterity of keeping ſo much of it, and for ſo long a time, as needs, upon the Brim of a *Ring* that is half an Inch broad. He adds, that it is very difficult to contrive, that the middle of the Glaſs do always preciſely anſwer to the Brim of this *Ring*, ſeeing that the poſition of the Glaſs does always change a little in reſpect of the *Ring*, in proportion as 'tis worn, and as it muſt be preſſed becauſe of its inclination. He believes it alſo very hard, to give to the *Axis* or to the *Mandril*, which holds the Glaſs, that little

Inclination,

Inclination, that would be neceſſary for great Glaſſes, and to make the two *Mandrils* to have one and the ſame *Plain*, as is neceſſary. And, having done all this, he perſuades himſelf, that it is exceeding difficult, if not impoſſible, for two contrary motions, where ſo many pieces are, to reſt for a long time ſteddy and firm, as is requiſite for the not ſwarving from it a hair's thickneſs, ſince leſs than that can change all.

He goes on, and, ſeeing that this *Inventor* ſpeaks of Glaſſes of a thouſand, & ten thouſand foot, which he ſuppoſed not impoſſible to be made by this *Engine*, diſcourſes of what is neceſſary for the making Glaſſes of ſuch bigneſs; which he believes this *Inventor* may perhaps not have thought of. Wherefore he affirms, that if the *Table*, made by himſelf for the *Apertures* of Glaſſes (which is that, that is above delivered) be continued unto a thouſand feet, by taking always the *Subduplicate proportion* of *Lengths*, it will be found, that for pretty good ones, the *Aperture* muſt be of 15. Inches; for good ones, more than 18. and for ſuch as are excellent, more than 21. Inches: whence it may be judged, what piece of Glaſs, and of what thickneſs it muſt be, to reſiſt the working. But he proceeds to ſpeak of the *Inclination*, which the *Mandril* muſt have upon the *Plain* of the *Ring*, when the *Ring* ſhould have 10. or 12 Inches; and finds, that it would make but 6 or 7. minutes of inclination, and that a Glaſs would have leſs *Convexity*, and conſequently, leſs difference from a Glaſs perfectly plain, than the 7. or 8. part of a Line. And then he leaveth it to be judged, whether a Glaſs of ſuch a Length being found, we ought to hope, that a *Turn* can be firm enough to keep ſuch a piece of Glaſs in the ſame Inclination, ſo that a *Mandril* do not recede ſome Minutes from it: and, though even the Glaſs could be faſtned perfectly perpendicular to the *Mandril*, that theſe two *Mandrils* could be put in one and the ſame place, & that that little Inclination, which is requiſite, could be given, and the *Mandril* be continued to be preſſed in that ſame *Inclination*, according as the Glaſs is worn. All which particulars, he conceives to be very hard in the practice; not to mention, that the weight of the Glaſs, that ſhould be inclined to the *Horizon*, as 'tis repreſented by Mr. *Hook*, would make it ſlide upon the *Cement*, and ſo chance

change the *Center*; and that the Glaſs is not preſſed at the ſame time by the *Ring* but in one part on the ſide, *vid.* about a fourth; and that the parts of the Glaſs are not equally worn away, *&c.* What then, *ſaith he*, would becom of a Glaſs of 10000 feet, which, according to the ſaid Table, would have more than four feet, or four feet and nine inches, or five feet, ſeven inches *Aperture*, and of which the *Ring*, though it were two feet nine inches, would have but one minut of *Inclination*, and the Glaſs of 5 feet *Aperture* would have but 4 minuts, and the curvity of it would be leſs than the hundred part of a Line.

But, *ſaith he*, let us conſider, only a Glaſs of 300 foot, to ſee, what is to be hoped of that, and to know at leaſt the difficulty, to be met with in making a Glaſs only of that Length. A Glaſs then of 300 foot, according to his Table, muſt have more than 8 inches *Aperture*, which maketh but 16 minuts of its *Circle*, and it ſhould have more than 11 inches, if it be an excellent one. If Mr. *Hook* (adds he) did uſe but his *Ring* of 6 inches, which he would uſe from twelve to an hundred foot Glaſs, the *Inclination*, which the *Axis*, or *Mandril*, that bears his Glaſs, ſhould have, ſhould be but 16 minuts, and the *Curvity* of the Glaſs would be leſs than the eighth part of a Line, and if he ſhould uſe a bigger, the *Inclination* would be proportionable.

Whence it may be judged (continues he) that we are yet very far from ſeeing *Animals &c.* in the *Moon*, as Monſieur *Des Cartes* gave hope, and Mr. *Hook* deſpairs not of. For, he believes by what he knows of *Teleſcopes*, that we are not to look for any above 300 or 400 foot at moſt; and he fears, that neither *Matter* nor *Art* will go even ſo far.

When therefore (*ſaith he*) a Glaſs of 300 foot ſhould bear an Eye-glaſs of 6 inches (which would appear wonderful) it would magnifie but 600. times in *Diameter*, that is, 360000 times in *Surface*: but ſuppoſe, that ſuch could be made, as would magnifie a 1000 times in *Diameter*, and 1000000. of times in *Surface*, admitting there were but 60000 leagues from the *Earth* to the *Moon*, and that the ſmalneſs of the *Aperture* of the Glaſſes (which yet would diminiſh the Light more than 36 times) and the obſtacle of the Air were not conſidered, we ſhould not

ſee

ſee the *Moon*, but as if we were a 100, or at leaſt, 60. leagues diſtant from her without a Glaſs. He here wiſhes, that thoſe, that promiſe to make us ſee *Animals* and *Plants* in the Moon, had thought on what our naked Eyes can make us diſcern of ſuch Objects, only at 10 or 12 leagues diſtance.

But this he would not have underſtood as a diſcouragement from ſearching with all care and earneſtneſs after the means of making long *Teleſcopes*, or of facilitating the working thereof; but only as an Advertiſement to thoſe, who light upon the *Theory* of any *Engine*, not to expoſe it preſently as poſſible and uſeful, before they have tried it, or if it have ſucceeded in ſmall, not to endeavour to perſuade, that it will alſo ſucceed in great.

As it may happen (*ſaith he*) that the Engin of Mr. *Hook* may, by uſing all neceſſary precautions, ſucceed in the making of *Eye-Glaſſes*, or *ſmall* Optick-Glaſſes, but not in making *great* ones; as we ſee, that an inſtrument compoſed of two Rulers, wherewith are traced Portions of Circles, ſucceeds well enough in *ſmall*, but when there is no more than half a Line, a quarter of a Line, or leſs convexity, it will be no longer juſt at all, as he tells us to have made the proof of it in Circles drawn by the means of one of theſe Inſtruments, made by one of the beſt Workmen in his time, who, whilſt he lived, eſteemed them above price, although they be not juſt; as others and my ſelf (*ſaith he*) have by tryal found, when we endeavoured to make *Moulds* by their means, & as thoſe, who by the like Inſtrument laboured to trace portions of Circles of 80 or 100 foot, *&c. Diameter*, can atteſt.

But, notwithſtanding all this, he hath thought upon two or three things, which he thinks may remedy ſome inconveniencies of Mr. *Hook* his *Turn*. The *firſt* is, to invert the Glaſs, and to put it under the *Ring*, that ſo not only the Glaſs may be placed more *Horizontally*, and not ſlide upon the *Cement*, but that the *Sand* alſo, and the *Putty* may ſtay upon the Glaſs.

The *other* is, that there muſt be two *Poppetheads*, into which the *Mandril* muſt paſs, where the *Ring* is to be faſtned; and the *Mandril* muſt be perfectly *Cylindrical*, that ſo it may advance upon the Glaſs as it wears away by the means of its weight, or by the means of a ſpring, preſſing it, without wrigling from one place to another, as it would preſently happen in the faſhion,

as the *Turn* is compoſed. For, when the Glaſſes do wear, eſpecially when they are very *convex*, it cannot be otherwiſe, but the *Mandril* will play and wrigle, before the *Scrue* be made firm.

But he doubts, whether all can be remedied, which he leavs to the induſtry of Mr. *Hook*, conſidering what he ſaith in the *Preface* of his *Micrography*, touching a Method, he knows, of finding out as much in *Mechanicks*, as can be found in *Geometry* by *Algebra*.

Beſides this, he taketh notice, that moſt of thoſe that medle with *Optick-Glaſſes*, give them not as much *Aperture*, nor charge them ſo deep as they ought. And he inſtances in the *Teleſcope*, which His *Majeſty* of *Great Britain* preſented the *Duke* of *Orleans* with, *videl.* that it did bear but 2 inches, and 9 lines *French*, for its greateſt *Aperture*, though there be 5 or 6 leſſer *Apertures*, of which it ſeems (*ſaith he*) the Artificer would have thoſe, that uſe it, ſerve themſelves more ordinarily, than of the greateſt; which conveys but almoſt half as many Rays as it ſhould do, according to his Calculation, which is, as 9 to 16; Whereas, according to his *Table* of *Apertures*, an excellent 35 foot *Teleſcope* ſhould bear 4 inches *Aperture* in proportion to *excellent* ſmall ones. He notes alſo, that the Eye-glaſs of the ſaid *Teleſcope*, compoſed of 2 Glaſſes, hath no more effect, when it is moſt charged, than a Glaſs of $4\frac{1}{2}$ inches; which makes it magnifie not a 100 times. And he finds by Mr. *Hook*, that he eſteems a *Teleſcope* made in *London* of 60 feet, (which amount to about 57 feet of *France*, the foot of *France* being to that of *England* as about 15 to 16) becauſe it can bear at leaſt 3 *Engliſh* inches *Aperture*, and that there are few of 30 feet, that can bear more than 2 inches, (which is but $22\frac{1}{12}$ Lines *French*) although he (M. *Auzout*) gives no leſs *Aperture*, than ſo, to a 15 foot-*Teleſcope*, and his of 21 feet hath ordinarily 2 Inches, 4 Lines, or 2 inches, 6 Lines *Aperture*.

This Diſcourſe he Concludeth with exhorting thoſe, that work *Optick-Glaſſes*, to endeavor to make them ſuch, that they may bear great *Apertures* and deep Eye-glaſſes; ſeeing it is not the length that gives eſteem to *Teleſcopes*; but on the contrary renders them leſs eſtimable, by reaſon of the trouble accompanying

panying them, if they perform no more, than ſhorter ones. Where, by the by, he takes notice, that he knows not yet, what *Aperture* Signor *Campani* gives to his Glaſſes, ſeeing he hath as yet ſignified nothing of it; but that the ſmall one, ſent by him to Cardinal *Antonio*, hath no more *Aperture*, than ordinary ones ought to have.

He promiſes withall, that he will explicate this way in his *Treatiſe of the uſefulneſs of Teleſcopes*, where he intends to aſſign the Bigneſs of the *Diameter* of all the *Planets*, and their proportion to that of the *Sun*; as alſo, that of the *Stars*, which he eſteems yet much leſs, than all thoſe have done, that have written of it hitherto; not believing, that the *Great Dog*, which appears to be the faireſt Star of the *Firmament*, hath 2 *Seconds* in *Diameter*, nor that thoſe, which are counted of the ſixth Magnitude, have 20 *thirds*; nor thinking, that all the Stars, that are in the *Firmament*, do enlighten the Earth as much as a Luminous Body of 20 *ſeconds* in *Diameter* would do, or, becauſe there is but one half of them at the ſame time above our *Horizon*, as a Body of 14 *ſeconds* in *Diameter*; and as the 18432th part of the *Sun* would enlighten us, or as the *Sun* would do, if we were 14 times more diſtant from it, than *Saturn*, and 137 times further, than the Earth: Which, *he ſaith*, would not be credible, if he did not endeavor to evince it both by *Experience* and *Reaſon*. And he doubts not, but that *Venus*, although ſhe ſends us no Light but what is reflected, does ſometimes enlighten the *Earth* more, than all the Stars together. Yet he would not have us imagine, from what he hath ſpoken of the ſmalneſs of the Stars, that *Teleſcopes* do not magnifie them by reaſon of their great diſtance, as they do *Planets*; for this he judgeth a Vulgar Error, to be renounced. *Teleſcopes* magnifie the *Stars* (*ſaith he*) as much in proportion, as they do all other Bodies, ſeeing that the demonſtration of their magnifying is made even upon *Parallel* rays, which do ſuppoſe an infinite diſtance, though the Stars have none ſuch: And if the *Teleſcopes* did not magnifie the Stars, how could they make us ſee ſome of the *fiftieth*, and it may be ſome of the *hundreth*, and *two hundreth* Magnitude, as they do, and as they would ſhew yet much leſſer ones, if they did magnifie more?

Mr. Hook's *Answer to Monsieur* Auzout's *Considerations, in a Letter to the Publisher of these* Transactions.

SIR,

Together with my most hearty thanks for the favour you were pleased to do me, in sending me an *Epitome* of what had been by the ingenious Monsieur *Auzout* animadverted on a description, I had made of an *Engine* for *grinding spherical Glasses*, I thought my self obliged, both for your satisfaction, and my own Vindication, to return you my present thoughts upon those Objections. The chief of which seems to be against the very *Proposition* it self: For it appears, that the *Objector* is somewhat unsatisfied, that I should propound a thing in *Theory*, without having first tried the *Practicableness* of it. But first, I could wish that this worthy Person had rectified my mistakes, not by speculation, but by experiments. Next, I have this to answer, that (though I did not tell the *Reader* so much, to the end that he might have the more freedom to examine and judg of the contrivance, yet) it was not meer *Theory* I propounded, but somewhat of *History* and *matter of Fact*: For, I had made trials, as many as my leisure would permit, not without some good success; but not having time and opportunity enough to prosecute them, I thought it would not be unacceptable to such, as enjoyed both, to have a description of a way altogether *New*, and *Geometrically* true, and seemingly, not unpracticable, whereof they might make use, or not, as they should see reason. But nothing surprised me so much, as, that he is pleased (after he had declared it a fault, to write this *Theory*, without having reduced it to practice) to lay it, as he seems to do, in one place of his book, *p.* 22 upon the *Royal Society*. Truly, *Sir*, I should think my self most injurious to that *Noble Company*, had I not endeavoured, even in the beginning of my Book, to prevent such a misconstruction. And therefore I cannot but make this interpretation of what Monsieur *Auzout* saith in this particular, that either he had not so much

much of the Language wherein I have written, as to underſtand all what was ſaid by me, or, that he had not read my *Dedication* to the *Royal Society*, which if he had done, he would have found, how careful I was, that that *Illuſtrious Society* ſhould not be prejudiced by my *Errors*, that could be ſo little advantaged by my *Actions*. And indeed, for any man to look upon the matters publiſhed by their Order or Licence, as if they were *Their* Senſe, and had *Their* Approbation, as *certain* and *true*, 'tis extremely wide of their intentions, ſeeing they, in giving way to, or encouraging ſuch publications, aim chiefly at this, that *ingenious conceptions*, and important *philoſophical matter of Fact* may be communicated to the learned and enquiring World, thereby to excite the minds of men to the examination and improvement thereof. But, to return; As to his *Objections* againſt the *Matter*, I do find that they are no more againſt mine, than any other way of *Grinding Glaſſes*; nor is it more than I have taken notice of my ſelf in this Paſſage of the ſame *Paragraph*, of which ſort are alſo thoſe difficulties he raiſes about *Long Glaſſes*, which are commonly known to ſuch, as are converſant in making them. *It would be convenient alſo* (theſe are my words) *and not very chargeable, to have four or five ſeveral Tools: One*, &c. *And, if curioſity ſhall ever proceed ſo farr, one for all lengths, between* 1000. and 10000. *foot long*; *for indeed, the* Principle *is ſuch, that ſuppoſing* the Mandrils well *made, and of a good length, and ſuppoſing* great care *be uſed in working and poliſhing them, I ſee no reaſon, but that a Glaſs of* 1000. *nay,* 10000. *foot long may be made, as well as one of* 10. *For, the reaſon is the ſame, ſuppoſing the* Mandrils *and* Tools *be made ſufficiently ſtrong, ſo that they cannot bend; and ſuppoſing alſo, that the Glaſs out of which they are wrought, be capable of ſo great a regularity in its parts, as to its Refraction.* But next, I muſt ſay that his *Objections* to me, ſeem not ſo conſiderable, as perhaps he imagines them. For, as to the poſſibility of getting Plates of Glaſs thick and broad enough without veins, I think *that* not now ſo difficult here in *England*, where I believe is made as good, if not much better Glaſs for *Optical Experiments*, than ever I ſaw come from *Venice*. Next, though it were better, that the thickeſt part of a long *Object-Glaſs* were exactly in the middle, yet I can aſſure Monſieur *Auzout*, that it may be a very

good

good one, when it is an Inch or two out of it. And I have a good one by me at preſent, of 36. foot, that will bear an *Aperture*, if *Saturn* or the *Moon* in the *twilight*, be look'd on with it, of $3\frac{1}{2}$ Inches over, and yet the thickeſt part of the Glaſs is a great way out of the middle. And I muſt take the liberty to doubt, whether ever my *Animadverſor* ſaw a long Glaſs, that was otherwiſe; as he might preſently ſatisfie himſelf by a way I could ſhew him (if he did not know it) whereby the difference of the thickneſs of the ſides might be found to the hundreth part of a Line.

As to the exceeding exactneſs of the *Figure* of Long *Object-Glaſſes*, 'tis not doubted, but that it is a matter difficult enough to be attained any way: but yet, I think, much eaſier by *Engine*, than by *Hand*; and of all *Engines*, I conceive, none more plain and ſimple, than that of a *Mandril*. And for making *ſpherical Glaſſes* by an *Engine*, I am apt to think, there hardly can be any way more plain, and more exact, than that which I have deſcribed; wherein there is no other motion, than that of two ſuch *Mandrils*, which may be made of ſufficient ſtrength, length, and exactneſs, to perform abundantly much more, than I can believe poſſible to be done otherwiſe than by chance, by a man's hands or ſtrength unaſſiſted by an *Engine*, the motion and ſtrength being much more certain and regular. I know very well, that in making a 60. foot Glaſs by the ſtrength of the hand, in the common way, not one of ten that are wrought, will happen to be good, as I have been aſſured by Mr. *Reeves*; who, I am apt to think, was the firſt that made any good of that length. For the *Figure* of the *Tool* in that way is preſently vitiated by the working of the Glaſs, and without much *gaging* will not do any thing conſiderable. Beſides, the ſtrength of a man's hands, applied to it for the working and poliſhing of it, is very unequal, and the motions made, are very irregular; but in the way, I have ventured to propoſe, by *Mandrils*, the longer the *Glaſs* and *Tool* are wrought together, the more exact they ſeem to be, and if all things be ordered, as they ſhould be, the very poliſhing of the Glaſs, does ſeem moſt of all to rectifie the *Figure*.

As to what he objects, that the Tool does only touch the Glaſs in a *Mathematical Circle*; that is true, perhaps, at firſt, but before the Glaſs is wrought down to its true *Figure*, the *Edge* of the *Tool* will

will be worn or grownd away, ſo as that a Ring of an inch broad may be made to touch the *Spherical Surface* of the Glaſs; nay, if it be neceſſary (without much trouble, eſpecially in the grinding of longer Glaſſes) the whole *Concave Surface* of the *Tool* may be made to touch a Glaſs. Beſides, that as to the keeping a quantity of the ſame ſand and Powders of ſeveral fineſſes, according as the glaſs wears, the ſame is poſſible to be don, as with the ſame Sand wrought finer by working in the Ordinary way.

The giving the *Inclination* to the *Mandrils*, is not at all difficult; though perhaps to determine the length exactly which the Glaſs ſo made ſhall draw, is not ſo eaſie: But 'tis no matter, what length the Glaſs be of, ſo it be made good, whether 60 or 80 foot, or the like. Nor is it ſo very difficult, to lay them both in the ſame *Plain*. And to keep them *ſteddy*, when once fix'd, is moſt eaſie.

As to the Calculation of the propriety of a Glaſs of a thouſand foot, perhaps for that particular Length, I had not, nor have as yet calculated, that the Convexity of one of eighteen inches broad, will not be above a ſeventh part of a Line. But it does not thence follow, that I had not conſidered the difficulties, that would be in making of it. For, I muſt tell him, that I can make a *Plano-convex* Glaſs, though its convexity be of a ſmaller ſphere than is uſual for ſuch a length, to be an *Object-Glaſs* of about 150 foot in Length, nay of 300 foot, and either longer or ſhorter, *without* at all *altering the convexity*. So that, if he will by any Contrivance he hath, give me a *Plano-convex* Glaſs of 20, or 40 foot *Diameter*, without *Veins*, and truly wrought of that *Figure*, I will preſently make a *Teleſcope* with it, that with a ſingle Eyglaſs ſhall draw a thouſand foot: Which *Invention*, I ſhall ſhortly diſcover, there being, I think, nothing more eaſie and certain. And if a *Plano-convex* Glaſs can be made of any *Sphere* between twenty and fourty foot *radius*, ſo as that both the *Convex* and *Plain* ſide of the Glaſs be exactly poliſh'd of a true *Figure*, I will ſhortly ſhew, how therewith may be made a *Teleſcope* of any Length, ſuppoſing the Glaſs free from all kind of *Veins*, or inequality of *Refraction*.

As for the ſliding of the Glaſs upon the *Cement*, I ſee no reaſon at all for it, at leaſt in the *Cement*, I make uſe of, having never obſerved any ſuch accident in hard *Cement*. And

And for the Bearing of the *Ring* againſt one ſide of the Glaſs only at a time, I cannot ſee, why *that* ſhould produce any inequality, ſince all the ſides of the Glaſs have ſucceſſively the ſame preſſure.

His ratiocination concerning a Glaſs of 300 foot, is much the ſame with the former, about the difficulty of working a true ſurface of a convenient figure; which how conſiderable both *that* and his Concluſion thereupon (*videl. That we are not to expect Glaſſes of above* 300 *or* 400 *foot long at moſt, and that neither* Matter *nor* Art *will go ſo far*) is, may be judged from what I have newly told you of making any *Object-Glaſs* of any Length.

And for his good wiſhes, that thoſe, who promiſe to make him ſee *Plants* or *Animals* in the *Moon* (of which I know not any, that has done ſo, though perhaps there may be ſome, notwithſtanding his Objections, that do not yet think it impoſſible to be done) had conſidered, what a Man is able to ſee with his *bare* Eye at 60 Leagues diſtance: I cannot but return him my wiſhes, that he would conſider the difference between ſeeing a thing through the *Groſs* and *Vaporous* Air neer the Earth, and through the Air over our heads: Which, if he obſerve the Moon in the *Horizon*, and neer the *Zenith* with a *Teleſcope*, he will experimentally find; and, having done ſo, he will perhaps not be ſo diffident in this matter.

Concerning his Advertiſement to ſuch, as publiſh *Theories*, I find not, that he hath made uſe of it in his own caſe. For, in his *Theory* about *Apertures* he ſeems to be very poſitive, not at all doubting to rely upon it, *vid.* that the *Apertures* muſt be *thus* and *thus* in *great* Glaſſes, becauſe he had found them *ſo* or *ſo* in ſome *ſmall* ones.

For his Propoſal of amendments of ſome inconveniencies in this way, I return him my thanks; but as to his firſt I believe, that the matter may be conteined as wel in the *Concave* Tool, as on the *convex* Glaſs. And as to that of 2 *Peppet-heads*, I do not well underſtand it, if differing from mine; and the keeping of the Tool upon the Glaſs with a ſpring or weight, muſt quickly ſpoyl the whole; ſince, if either of the *Mandrils* will eaſily yield backwards, the *regularity* of *all* will be ſpoiled: and as to the wrigling and playing of the *Mandril*, I do not at all apprehend it.

His

His *Theory* of *Apertures*, though he ſeems to think it very authentick, yet to me it ſeems not ſo cleer. For, the ſame Glaſs will endure greater or leſſer *Apertures*, according to the leſſer or greater Light of the *Object*: If it be for the looking on the *Sun* or *Venus*, or for ſeeing the *Diameters* of the *Fix'd Stars*, then ſmaller *Apertures* do better; if for the *Moon* in the *daylight*, or on *Saturn*, or *Jupiter*, or *Mars*, then the largeſt. Thus I have often made uſe of a 12 foot-Glaſs to look on *Saturn* with an *Aperture* of almoſt 3 inches, and with a ſingle Eye-glaſs of 2 inches *double convex*: but, when with the ſame Glaſs I looked on the *Sun* or *Venus*, I uſed both a ſmaller *Aperture*, and ſhallower *Charge*. And though M. *Auzout* ſeems to find fault with the *Engliſh* Glaſs of 36 foot, that had an *Aperture* of but $2\frac{1}{4}$ inches *French*; as alſo, with a 60 foot *Tube*, uſed but with an *Aperture* of 3 inches; yet I do not find, that he hath ſeen Glaſſes of that length, that would bear greater *Apertures*, and 'tis not impoſſible, but his *Theory* of *Apertures* may fail in longer Glaſſes.

Of a means to illuminate an Object in what proportion one pleaſeth; and of the Diſtances requiſite to burn Bodies by the Sun.

One of the means uſed by M. *Auzout* to enlighten an Object, in what proportion one pleaſeth, is by ſome great *Object-Glaſs*, by him called a *Planetary* one, becauſe that by it he ſhews the difference of Light, which all the *Planets* receive from the *Sun*, by making uſe of ſeveral *Apertures*, proportionate to their diſtance from the *Sun*, provided that for every 9 foot draught, or thereabout, one inch of *Aperture* be given for the *Earth*. Doing this, one ſees (*ſaith he*) that the Light which *Mercury* receives, is far enough from being able to burn Bodies, and yet that the ſame Light is great enough in *Saturn* to ſee cleer there, ſeeing that (to him) it appears greater in *Saturn*, than it doth upon our *Earth*, when it is overcaſt with Clouds: Which (he adds) would ſcarce be believed, if by means of this Glaſs it did not ſenſibly appear ſo; Whereof he promiſes to diſcourſe more fully in his

Treatiſe of the uſefulneſs of great Optick-Glaſſes, where he alſo intends to deliver ſeveral Experiments, by him made, 1. Touching the quantity of Light, which a Body, that is 10. 15 and 20 times, *&c.* remoter than *Saturn*, would yet receive from the *Sun*. 2. Touching the quantity of Light, by which the *Earth* is illuminated even in the *Eclipſes* of the *Sun*, in proportion of their bigneſs. 3. Touching the quantity of Light, which is neceſſary to burn Bodies: he having found, that not abating the Light, which is reflected by the Surfaces of the Glaſs (whereof he confeſseth, he doth not yet exactly know the quantity) there would be neceſsary about 50 times as much Light, as we have here, for the burning of *Black* Bodies; and neer 9 times more for the burning of *White* Bodies, than for the burning of *Black* ones: and ſo obſerving the immediate proportions between theſe two, for burning Bodies of *other* Colors. Whence (he tells us) he hath drawn ſome conſequences, touching the diſtance, at which we may hope, to burn Bodies here, by the means of *great Glaſſes* and great *Looking-glaſſes*. So that (*ſaith he*) we muſt yet be ſeven times neerer the *Sun*, than we are, to be in danger of being burned by it. Where he mentions, that having given *Inſtructions* to certain perſons, gon to travel in *Hot Countries*, he hath among other particulars recommended to them, to try by means of great *Burning-glaſſes*, with how much leſs *Aperture* they will burn *there*, than *here*, to know from thence, whether there be more Light *there* than *here*; and how much; ſince this perhaps may be the only means of trying it, ſuppoſing, the ſame matters be uſed: although the difference of the Air already heated, both in *hot Countries*, and in the *Planets*, that are neerer than we, may alter, if not the quantity of Light, at leaſt that of the Heat, found there.

A further Account, touching Signor Campani's *Book and Performances about* Optick-glaſſes.

In the above-mentioned *French* Tract, there is alſo conteined M. *Auzout's* Opinion of what he had found New in the *Treatiſe* of Signor *Campani*, which was ſpoken of in the firſt *Papers* of theſe *Tranſactions*, concerning both the Effect of the *Teleſcopes*, contrived after a peculiar way by the ſaid *Campani* at *Rome*, and his

his New Obſervations of *Saturn* and *Jupiter*, made by means thereof.

Firſt therefore, after that M. *Auzout* had raiſed ſome ſcruple againſt the Contrivance of Signor *Campani* for making *Great Optick-Glaſſes* without *Moulds*, by the means of a *Turn lath*, he examines the *Obſervations*, made with ſuch *Glaſſes*: Where, having commended *Campani*'s ſincerity in relating what he thought to have ſeen in *Saturn*, without accomodating it to M. *Hugens*'s *Hypotheſis*, he affirms, that ſuppoſing, there be a *Ring* about *Saturn*, Signor *Campani* could not ſee in all thoſe different times, that he obſerved it, *the ſame Appearances*, which he notes to have *actually* ſeen. For, having ſeen it ſometimes in *Trine Aſpect* with the *Sun*, and *Oriental*; ſometimes, in the ſame *Aſpect*, but *Occidental*; ſometimes in *Sextil Aſpect*, and *Occidental*; at another time, again in *Trine*, and *Oriental*, this Author cannot conceive, how *Saturn* could in all theſe different times have no difference in its *Phaſis*, or keep always the ſame *Shadow*; ſeeing that, according to the *Hypotheſis* of the *Ring*, when it was *Oriental*, it muſt caſt the *Shaddow* upon the *left* ſide of the *Ring* beneath, without caſting any on the *right* ſide: and when it was *Occidental*, it could not but caſt it on the *right* ſide beneath, and nothing of it on the other.

Concerning the *Shadow above*, which *Campani* affirms to be made by the *Ring* upon the Body of *Saturn*, M. *Auzout* judges, that there could be no ſuch *Phænomenon*, by reaſon of its *Northern Latitude* at the times, wherein the *Obſervations* were made, *vid.* in *April* 1663; in the midſt of *Auguſt*, and the beginning of *October*, next following, and in *April* 1664, except it were in *October*, and the *Shadow* ſtrong enough to become *viſible*.

But as to the *Shadow below*, he agrees with *Campani*, that it does appear, yet not as he notes it, ſeeing that it muſt be ſometimes on the one ſide, ſometimes on the other; and towards the *Quadrat* with the *Sun* it muſt appear biggeſt, as *indeed* he affirms to have ſeen it himſelf *this* year, inſomuch that ſometimes it ſeemed to him, that it covered the whole *Ring*, and that the *Shaddow*, joyning with the obſcure ſpace between both, did interrupt the circumference of the *Ring*; but beholding it at other times in a cleer Sky, and when there was no Trepidation of the Air,

he thought, that he ſaw alſo the Light continued from without, although very ſlender. But he acknowledges, that he could never yet *preciſely* determine, by how much the largeneſs of the *Ring* was bigger than the *Diameter* of *Saturn's* Body. As for the proportion of the Length to the Breadth, he affirms, to have alwaies eſtimated it to be two and a half, or very neer ſo; and to have found in his *Obſervations*, that in *January* laſt, one time, the length of *Saturn* was 12 *Lines*, and the breadth 5. Another time, the length was 12. *Lines*, and the breadth 4. and this by a peculiar method of his own. But yet he acknowleges alſo, that ſometimes he hath eſtimated it as 7, to 3. and at other times as 13. to 5. and that if there do not happen a change in the magnitude of the *Ring* (as it is not likely there does) that muſt needs proceed from the Conſtitution of the air, or of the Glaſs's having more or leſs *Aperture*, or from the difficulty of making an exact eſtimate of their proportions. However it is not much wide (ſaith he) of two and an half, although *Campani* make the length of the *Ring* but double to its breadth.

Monſieur *Auzout* believes, that he was one of the firſt that have well obſerved this ſhadow of *Saturn*'s Body upon its *Ring*; which he affirms happened two years ſince; when, obſerving in *July*, for the firſt time, with a *Teleſcope* of 21. and then another of 27. foot, he perceived, that the *Angle* of the obſcure ſpace on the *right ſide* beneath, was bigger and wider, than the three other *Angles*, and that ſome interruption appear'd *there*, between the *Ring*, and the *Body of Saturn*; of which he ſaith to have given notice from that time to all his friends, and in particular, as ſoon as conveniently he could, to Monſieur *Hugens*.

He confeſſeth, that he hath not had the opportunity of obſerving *Saturn* in his *Oriental Quadrat*; yet he doubts not, but that the *ſhadow* appears on the *Left-ſide*, conſidering, that the *Exiſtence* of the *Ring* can be no longer doubted of, after ſo many *Obſervations* of the *ſhadow* caſt by *Saturn*'s Body upon it, according as it muſt happen, following that *Hypotheſis*; there being no reaſon, why it ſhould caſt the ſaid *ſhadow* on one ſide, and not on the other.

Concerning the Obſervation of *Jupiter* and its *ſatellites*, the famous *Aſtronomer* of *Bononia*, *Caſſinus*, having publiſhed,

liſhed, that on the 30. day of *July*, 1664. at 2½ of the clock in the morning, he had obſerv'd, with *Campani*'s Glaſſes, that there paſſed through the broad obſcure *Belt* of *Jupiter* two obſcurer *ſpots*, by him eſteemed to be the *ſhadows* of the *Satellites*, moving between *Jupiter* & the *Sun*, and eclipſing him, and emerging from the Occidental Brim thereof: This *Authour* did firſt conceive, that they were not *ſhadows*, but ſome *Sallies*, or *Prominencies* in that *Belt*; which he was induced to believe, becauſe he perceived not, that that *Prominency*, which he there ſaw, was ſo black, nor ſo round as *Caſſini* had repreſented his *ſpots*; wherefore, ſeeing it but little differing in colour, from the *Belt*, and ſo not judging it round, becauſe it did ſtand only about half its diameter out of the *Belt*, he perſuaded himſelf, that it was rather a *Sally*, or *Prominency* of the *Belt*, than a round *ſhadow*, as that of a *Satellite* of *Jupiter* muſt have bin. But having been ſince informed of *all* the *Obſervations* made by *Caſſini* and *Campani*, with the *New* Glaſſes, and ſeen his *Figure*, he candidly and publickly wiſheth, that he had not ſpoken of that *Sally*, or *Prominency*; advowing that he can doubt no longer, but that it was the *ſhadow* of the *Satellit* between *Jupiter* and the *Sun*, having ſeen the other emerge, as ſoon as with a 20. foot Glaſs he made the Obſervation, and having not perceiv'd theſe *ſhadows* with a 12. foot Glaſs: But although he grants that they did gheſs better than he, yet he doth it with this *proviſo*, *vid.* in caſe they made *that* Obſervation of *July* 30. not with their 36. but 12. or 17. foot *Teleſcope*. If it be wondred at, that Monſieur *Auzout* did not ſee this *ſhadow* move, he allegeth his indiſpoſition for making *long Obſervations*, and addeth, that it may be much more wondred at, that neither *Campani* nor himſelf did ſee upon the obſcure *Belt* the Bodies of the *Satellites*, as parts more Luminous than the *Belt*. For (ſaith he) although the *Latitude* was *Meridional*, it being no more than of 9. or 10. minutes, the Body of the *Satellites* ſhould, thinks he, paſs between *us* and the *Belt*, eſpecially according to *Campani*, who maketh the *Belt* ſo large, and puts the *ſhadows* farr enough within the ſame. This maketh him conclude, that either they have not obſerved well enough, or that the motion of the *Satellites* doth not exactly follow the *Belts*, and is inclin'd unto them. Whereupon he reſolves, that when he ſhall know that they are to paſs between *Jupiter* and *us*, and to be over againſt the *Belt*, that then

then he will obſerve, whether he can ſee them appear upon the *Belt*, as upon a darker ground, eſpecially, the *third* of them, which is ſenſibly greater, and more Luminous, than the reſt. He hopeth alſo, that in time, the *ſhadow* of *Saturns Moon* will be ſeen upon *Saturn*, although we are yet ſome years to ſtay for it, and to prepare alſo for better Glaſſes.

From this rare Obſervation, he inferrs the *Proportion* of the *Diameter* of the *Satellites* to that of *Jupiter*; and judgeth, that no longer doubt can be made of the turning of theſe 4. *Satellites*, or *Moons* about *Jupiter*, as our *Moon* turns about the *Earth*, and after the ſame way as the reſt of the Celeſtial Bodies of our *Syſteme* do move: whence alſo a ſtrong conjecture may be made, that *Saturns* Moon turns likewiſe about *Saturn*.

Hence he alſo taketh occaſion to intimate, that we need not ſcruple to conclude, that if theſe two *Planets* have *Moons* wheeling about them, as our *Earth* hath one that moves about it, the conformity of theſe *Moons* with our *Moon*, does prove the conformity of our *Earth* with thoſe *Planets*, which carrying away their *Moons* with themſelves, do turn about the *Sun*, and very probably make their *Moons* turn about them in turning themſelves about their *Axis*; and alſo, that there is no cauſe to invent perplex'd and incredible *Hypotheſes*, for the receding from this *Analogie* ſince (ſaith he) if this be truth, the Prohibitions of publiſhing this doctrine, which formerly were cauſed by the offence of Novelty, will be laid aſide; as one of the moſt zealous Doctors of the contrary Opinion hath given cauſe to hope, witneſs *Euſtachius de Divinis*, in his *Tract* againſt Monſieur *Hugen*'s *Syſteme* of *Saturn*, *p.* 49. where we are inform'd, that that learned Jeſuit, *P. Fabry*, Penitentiary of S. *Peter* in *Rome*, ſpeaks to this purpoſe:

* *It hath been more than once asked of your Chieftains, whether they had a Demonſtration for aſſerting the motion of the Earth? They durſt never yet affirm they had; wherefore nothing hinders, but that the Church may underſtand thoſe Scripture-places, that ſpeak of this matter, in a* literal *ſence, and declare they ſhould be ſo underſtood, as long as the contrary is not evinced by any demonſtration; which*

* Ex veſtris, iiſque Coryphæis non ſemel quæſitum eſt, utrum aliquam haberent demonſtrationem pro *Terræ motu* adſtruendo. Nunquam auſi ſunt id aſſerere Nil igitur obſtat, quin loca illa in ſenſu literali Eccleſia intelligat, & intelligenda eſſe declaret, quamdiu nulla demonſtratione contrarium evin-

which, if perhaps it ſhould be found out by you (which I can hardly believe it will) in this caſe the Church will not at all ſcruple to declare, that theſe places are to be underſtood in a figurative and improper ſence, according to that of the Poet, Terræque Urbeſque recedunt.

citur; quæ ſi forte aliquando à vobis excogitetur (quod vix crediderim) in hoc caſu nullo modo dubitabit Eccleſia declarare, loca illa in ſenſu figurato & improprio intelligenda eſſe, ut illud Poetæ, *Terræque urbeſque recedunt.*

Whence this Author concludes, that the ſaid *Jeſuite* aſſuring us that the *inquiſition* hath not *abſolutely* declared, that thoſe Scripture-places are to be underſtood *literally*, ſeeing that the *Church* may make a contrary declaration, no man ought to ſcruple to follow the *Hypotheſis* of the *Earths motion*, but only forbear to maintain it in *publick*, till the prohibition be called in. But to return to the matter in hand, this Author, upon all theſe obſervations and relations of *Caſſini* and *Campani*, doth find no reaſon to doubt any more of the excellency of the Glaſs uſed by them, above his; except this difference may be imputed to that of the *Air*, or of the *Eys*. But yet he is rather inclined to aſcribe it to the goodneſs of their Glaſſes, and that the rather, becauſe, he would not be thought to have the vanity of magnifying his own; of which, yet he intimates by the by, that he cauſed one to be wrought, of 150 *Pariſian* feet; which though it proved none of the beſt, yet he deſpairs not to make good ones of *that*, and of far greater Length.

Signor Campani's *Anſwer*: and *Monſieur* Auzout's *Animadverſions thereon.*

The other part of this *French Tract*, conteining *Campani*'s Anſwer, and Mr. *Auzout* his *Reflections* thereon, begins with the pretended *Shadows* of the *Ring* upon *Saturn*, and of *Saturn* upon the *Ring*. Concerning which, the ſaid *Campani* declareth, that he never believed them to be *ſhadows*, made by the *Ring* upon the *Disk* of *Saturn*, or by the body of *Saturn* upon the *Ring*, but the *Rimms* of theſe bodies, which being *unequally* Luminous, did ſhew theſe appearances. In which Explication, forasmuch as it repreſents, that the ſaid *Campani* meant to note only the *Inequality of the Light*, which, *he ſaith*, his Glaſſes did diſcover, Mr. *Auzout* does

ſo

ſo far acquieſce, that he only wiſhes, that his own Glaſſes would ſhew him thoſe differences. Next to the Objection, made by Monſieur *Auzout*, againſt Signor *Campani*, touching the Proportion of the Length of the *Ring* to its breadth, *Campani* replyeth, that the Glaſſes of Monſieur *Auzout*, ſhew not all the particulars, that his do, and therefore are unfit for determining the true Figure and breadth of the apparent *Ellipſis* of the *Ring*. To which M. *Auzout* rejoyns, that he is diſpleaſed at his being deſtitute of better Glaſſes, but that it will be very hard for the future to convince *Campani* touching the *Proportion* of the *Ring*, ſeing that the breadth of the *Ellipſis* is always diminiſhing, although, if the declination of the *Ring* remains always the ſame, one can at alltimes know, which may have been its greateſt breadth. But he aſſures, that the breadth of the *Ring* is not the half of its length, and that it doth not ſpread out ſo much beyond *Saturn*'s Body, as he hath alleged. And withal deſirs to know, what can be anſwered by Sig. *Campani* to M. *Hugens*, who being perſuaded, that the Declination of the *Ring* is not above 23 deg. 30′ having ſeen the *Ring* to ſpread out above the Body of *Saturn*, concludes, in a Letter to M. *Auzout*, that the length of the *Ring* is more than treble the *Diameter* of *Saturn*'s body, which, according to *Campani*, is only as about 67 to 31. Which difference yet dos not appear to M. *Auzout* to be ſo great; but that M, *Hugens* perhaps will impute it to the Optical reaſon, which he (*Auzout*) hath alleged of the Advance of the light upon the obſcure ſpace; although he is of Opinion, he ſhould not have concluded ſo great a Length, if he had not ſeen the Breadth ſpread out more, than he hath done: for (*ſaith he*) if the Length of the *Ring* be to the body of *Saturn*, as $2\frac{1}{2}$ to 1. and the *Inclination* be 23 deg. 30′ the *Ring* will be juſt as large, as the body, without ſpreading out; but if the *Ring* be bigger, it will a little ſpread out; and if it were treble, it muſt needs ſpread out the half of its breadth, which hath not ſo appeared to him.

Further, to M. *Auzout's* change of Opinion, and believing, that the *Advance* or *Sally*, ſeen by him in *Jupiter*, was the *ſhadow* of one of his Moons, *Campani* declares, that he would not have him guilty of that change: Whereupon M. *Auzout* wonders, why *Campani* then hath not marked it in his *Figure*; and would gladly

ly know, whether that *Sally* be more eaſie to diſcover, than the *ſhadows* of the *Satellites*, which *Campani* believs, *Auzout* hath not ſeen; and whether he be aſſured, that thoſe obſcure parts, which he there diſtinguiſhes, do not change: for if they ſhould not change, then *Jupiter* would not turn about his *Axis*, which yet, he ſaith, it doth, according to the *Obſervation* made by Mr. *Hook*, *May* 9 1664. inſerted in the firſt papers of theſe *Tranſactions*. The full Diſcovery of which particular alſo he makes to be a part of *Caſſini's* and *Campani's* work, ſeeing that they ſo diſtinctly ſee the inequalities in the *Belts*, and ſee alſo ſometimes other *Spots* beſides the *ſhadows* of the *Satellites*: where he exhorts all the Curious, that have the conveniency of obſerving, to endeavor the diſcovery of a matter of that importance, which would prove one of the greateſt *Analogies* for the *Earth's Motion*.

An Account of Mr. Richard Lower's *newly publiſhed* Vindication *of Doctor* Willis's Diatriba *de* Febribus.

The Title of this Curious piece, is, *Diatribæ Thomæ Williſii Med. Doct. & Profeſſ. Oxon. De Febribus Vindicatio, Authore Richardo Lower, &c.* In it are occaſionally diſcuſſed many conſiderable Medical and Anatomical inquiries, as, Whether a Fever does conſiſt in an Effervescence of Blood? And if ſo, of what kind? Whether there be a *Nervous* and *Nutritious* Juice? Whether the office of ſanguification belongs to the Blood it ſelf, exiſting *before* thoſe *Viſcera* (at leaſt) that are commonly eſteemed to be the Organs of ſanguification? How *Nutrition* is performed, and the nouriſhing ſubſtance aſſimilated? Whether the Blood affords both the Matter for the ſtructure of the Body, and ſuch parts alſo, as are fit for the nouriſhment of the ſame? Whether the Pulſe of the Heart ceaſing, there remains yet a certain Motion in the blood, arguing, that *Pulſe* and *Life* do ultimately reſt in the *Blood*? Whether the Umbilical Veſſels convey the blood of the Mother to the Child, or whether the *Fœtus* be for the moſt part form'd and

acted by the circulating blood, before the existence of the Umbilical Vessels, or before the connecting of the *Fœtus* with the *Uterus*? A new Experiment to prove, that the *Chyle* is not transmuted into *Blood* by the *Liver*. A discourse of the Nature of the *Blood*, and what difference there is between the *Venal* and *Arterial* blood, and for what Uses both the one and the other are particularly designed. Where it is considered, what *Life* is, and whence the *Soul* of *Brutes*, and its subsistence, and operations do depend. It is also inquired into, what the uses of the *Lungs* are in *hot* Animals? And many other such material disquisitions are to be found in this small, but very Ingenious and Learned Treatise.

A Note touching a Relation, inserted in the last Transactions.

In the Experiment of killing *Ratle-Snakes*, mentioned in the last of the precedent Papers (wherein, by a mistake, these words, *The way*, were put for *A way*, or *An Experiment*) it should have been added, that the Gentleman there mention'd, did affirm, that, in those places, where the Wild *Penny-Royal* or *Dittany* grows, no *Ratle-Snakes* are observed to come.

Errata.

PAg. 59. line 11. read, *bignesses*, l. 20. r. *endure*, for, resist. l. 30. r. *those*, for, these. l. 31. r. *Plain*, for, place.

LONDON,

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Fig: 1

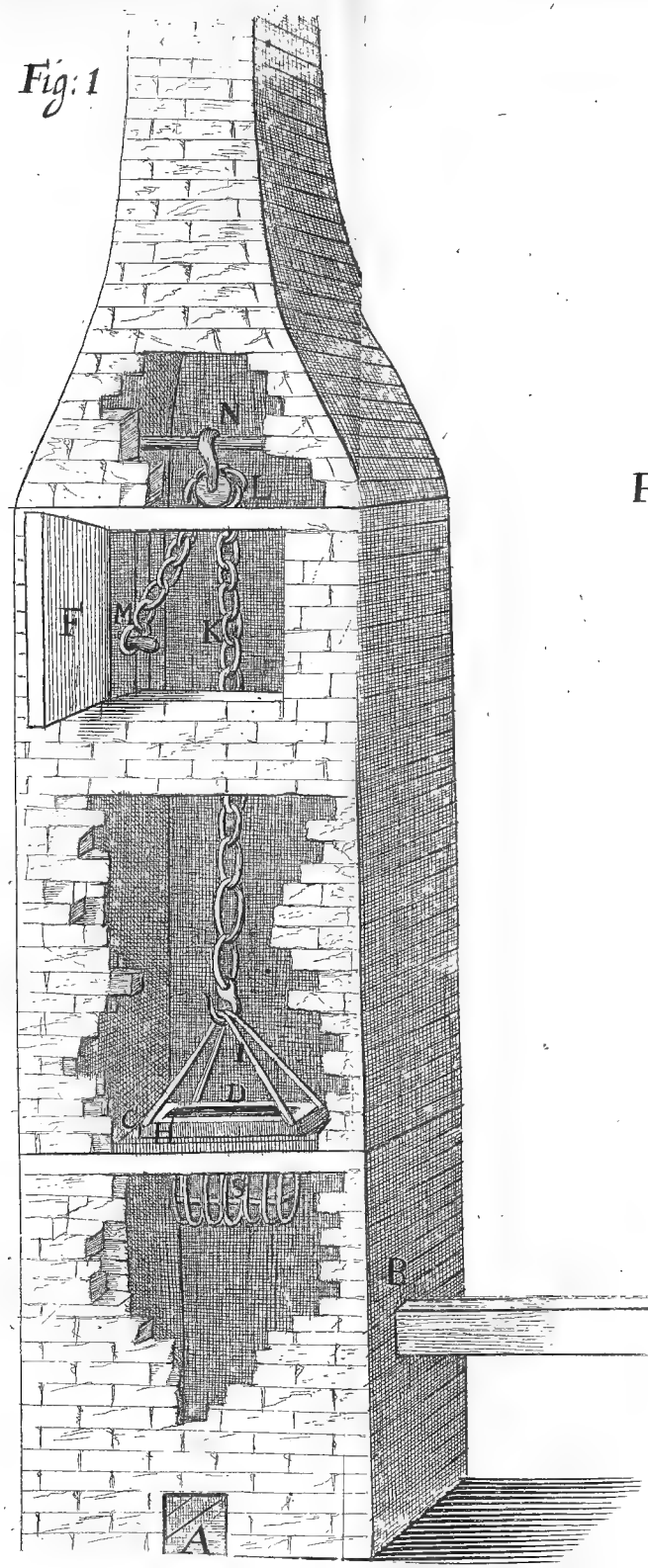

Fig: 2

Fig: 3

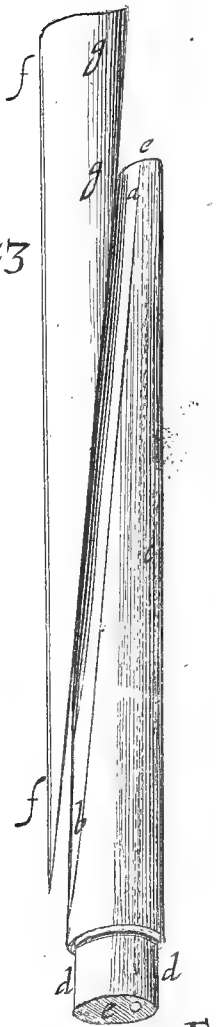

Fig: 4

PHILOSOPHICAL TRANSACTIONS.

Munday, *July* 3. 1665.

The Contents.

An Account, how Adits *and* Mines *are wrought at* Liege *without* Air-ſhafts, *communicated by Sir* Robert Moray. *A way to break* eaſily *and* ſpeedily *the hardeſt* Rocks; *imparted by the ſame* Perſon, *as he received it from Monſieur* Du Son, *the Inventor. Obſervables upon a* Monſtrous Head. *Obſervables in the Body of the Earl of* Belcarres, *ſent out of* Scotland. *A Relation of the deſigned Progreſs to be made in the* Breeding of Silk-worms, *and the* Making *of* Silk, *in* France. *Enquiries touching* Agriculture, *for* Arable *and* Meadows.

An Account, how Adits & Mines *are wrought at* Liege *without* Air-ſhafts, *communicated by Sir* Robert Moray.

IT is well known to thoſe converſant in *Mines*, that there is nothing of greater inconvenience in the working or *driving*, as they call it, of *Mines* or *Adits* under ground, for carrying away of Water, or ſuch *Minerals* as the *Mine* affords, than the *Damps*, *want*, and *impurity of Air*, that oc-

cur, when ſuch *Adits* are wrought or driven inward upon a *Level*, or near it, 20, 30, or 40. fathom, more or leſs: Aſwel becauſe of the expence of money, as of time alſo, in the *Ordinary* way of preventing or remedying thoſe inconveniences; which is, by letting down *ſhafts* from the *day* (as *Miners* ſpeak) to meet with the *Adit*; by which means the Air hath liberty to play through the whole work, and ſo takes away bad vapours and furniſhes good Air for Reſpiration. The Expence of which *ſhafts*, in regard of their vaſt depth, hardneſs of the Rock, drawing of water *&c.* doth ſometimes equal, yea exceed the *ordinary* charge of the whole *Adit*.

Amongſt the *Expedients* that have been deviſed to remedy this, there is one practiſed in the *Coal-mines*, near the Town of *Liege* (or *Luyck*) that ſeems preferable to all others for Efficacy, Eaſe, and Cheapneſs: the deſcription whereof followeth.

At the mouth or entry of the *Adit* there is a ſtructure raiſed of *Brick*, like a *Chimney*, ſome 28. or 30. foot high in all: at the bottom, two oppoſite ſides are (or may be) ſome $5\frac{1}{2}$ foot broad; and the other two, 5. foot: the wall $1\frac{1}{2}$ *Brick* thick. At the lower part of it, is a hole, ſome 9. or 10. inches ſquare, for taking out of the Aſhes, which when it is done, this Aſh-hole is immediately ſtopt ſo cloſe, as Air cannot poſſibly get in at any part of it. Then, ſome 3. foot above ground or more, there is on that ſide, that is next to the *Adit* or Pit, a ſquare hole of 8. or 9. inches every way, by which the Air enters to make the Fire burn: Into this hole there is fixed a ſquare *Tube* or *Pipe* of Wood, whereof the Joints and Chinks are ſo ſtopt with Parchment paſted or glewed upon them, that the Air can no where get in to the Pipe but at the end: And this Pipe is ſtill lengthned, as the *Adit* or Pit advanceth, by fitting the new Pipes ſo, as one end is alwaies thruſt into the other, and the Joints and Chinks ſtill carefully cemented and ſtopt as before. So the Pipe or Tube being ſtill carried on, as near as is neceſſary, to the wall or place, where freſh Air is requiſite; the Fire within the Chimney doth ſtill attract

(ſo

(ſo to ſpeak) Air through the Tube, without which it cannot burn, which yet it will do, as is obvious to conceive, (all Illuſtrations, and Philoſophical Explications being here ſuperfluous,) and ſo, while the Air is drawn by the fire from the fartheſt or moſt inward part of the *Mine* or *Adit*, freſh Air muſt needs come in from without, to ſupply the place of the other, which by its motion doth carry away with it all the vapors, that breath out of the ground; by which means the whole *Adit* will be alwaies filled with freſh Air, ſo that men will there breath as ſurely as abroad, and not only Candles burn, but Fire, when upon occaſion there is uſe for it for breaking of the Rock.

Now that there may be no want of ſuch freſh Air, the Fire muſt alwaies be kept burning in the Chimney, or at leaſt as frequently as is neceſſary: For which purpoſe there muſt be two of the Iron Grates or Chimneys, that when any accident befals the one, the other may be ready to be in its place, the Coals being firſt well kindled in it: but when the fire is neer ſpent, the Chimney or Grate being haled up to the dore, is to be ſupplied with freſh fuel.

The Figure of the Fabrick, Chimney, and all the parts thereof being hereunto annexed, the reſt will be eaſily underſtood.

Figure 1.

A. The *Hole* for taking out the Aſhes.

B. The *Square-hole*, into which the Tube or Pipe for conveying the Air is to be fixed.

C. The *Border* or *Ledge of Brick* or *Iron*, upon which the *Iron-grate* or *Cradle*, that holds the burning Coles, is to reſt, the one being exactly fitted for the other.

D. The *Hole* where the *Cradle* is ſet.

E. The woodden *Tube*, through which the Air is conveyed towards the *Cradle*.

F. The *Dore*, by which the *Grate* and *Cradle* is let in, which is

to be ſet 8. or 10. foot higher than the Hole D and the *Shutter* made of Iron, or Wood that will not ſhrink, that it may ſhut very cloſe; this *Dore* being made large enough to receive the *Cradle* with eaſe.

G. The *Grate* or *Cradle*, which is narrower below than above, that the Aſhes may the more eaſily fall, and the Air excite the Fire; the bottom being barred as the ſides.

H. The *Border* or *Ledge* of the *Cradle*, that reſts upon the *Ledge* C.

I. Four *Chains* of *Iron* faſtned to the four corners of the *Cradle*, for taking of it up, and letting of it down.

K. The *Chain* of *Iron*, to which the other are faſtned.

L. The *Pulley* of *Iron* or *Braſs*, through which the *Chain* paſſeth.

M. A *Hook*, on which the end of the *Chain* is faſtned by a *Ring*, the *Hook* fixed being placed in the ſide of the Dore.

N. A *Barr* of *Iron* in the Walls, to which the *Pulley* is faſtned.

The higher the *Shaft* of the Chimney is, the Fire draws the Air the better. And this Invention may be made uſe of in the *Pits* or *Shafts*, that are *Perpendicular*, or any wiſe inclining towards it, when there is want of freſh Air at the bottom thereof, or any moleſtation by unwholſom Fumes or Vapours.

A way to break eaſily *and* ſpeedily *the hardeſt* Rocks, *communicated by the ſame Perſon, as he received it from Monſieur* Du Son, *the Inventor.*

Though the Invention of breaking with eaſe, and diſpatch, hard Rocks, may be uſeful on ſeveral occaſions, the benefit is incomparably great, that may thereby accrue to thoſe, who have *Adits* or Paſſages to cut through hard *Rocks*, for making paſſage for Water to run out by, in *Mines* of *Lead*, *Tin*, or any other whatſoever; theſe *Adits* appearing to be the ſureſt, cheapeſt, and moſt advantagious way imaginable, for draining of the ſame.

That

That which is here to be deſcribed, was invented by one of the moſt Excellent *Mechanicks* in the World, *Monſieur du Son*, who lately put it in practice himſelf in *Germany*, at the deſire of the *Elector* of *Mentz*. The manner is, as followeth.

The *Mine* or *Adit* is to be made ſeven or eight foot high, which though it ſeem to make more work downwards, yet will be found neceſſary for making the better diſpatch by rendring the Invention more effectual.

There is a *Tool* of *Iron* well-ſteeled at the end, which cuts the Rock, (of the ſhape ſhewed by *Fig.* 2. here annexed;) 20. or 22. Inches long or more, and ſome 2 ½ Inches *Diameter* at the ſteeled end, the reſt being ſomewhat more ſlender. The ſteeled end is ſo ſhaped, as makes it moſt apt to pierce the Rock, the Angles at that end being ſtill to be made the more obtuſe, the harder the Rock is. This *Tool* is to be firſt held by the hand, in the place, where the Hole, to be made for the uſe, which ſhall here be ſhewed, is to be placed; that is, in the middle between the ſides of the Rock, that is to be cut, but as near the bottom as may be. The *Tool* being placed, is to be ſtruck upon with an Hammer, the heavier the better, either ſuſpended by a Shaft turning upon a Pin, or otherwiſe, ſo as one man may manage the Hammer, while another holds the Tool or Piercer. If it be hung in a *Frame*, or other convenient way, he that manageth it hath no more to do, but to pull it up at firſt as high as he can, and let it fall again by its own weight, the motion being ſo directed, as to be ſure to hit the Piercer right. After the ſtroke of the Hammer, he that holds the Piercer, is to turn it a little on its point, ſo that the Edges or Angles at the point may all ſtrike upon a new place: and ſo it muſt ſtill be ſhifted after every ſtroke, by which means, ſmall Chipps will at every ſtroke be broken off, which muſt from time to time be taken out, as need requires. And thus the work muſt be continued, till the *Hole* be 18. or 20. Inches deep, the deeper the better. This *Hole* being made as deep as is required, and kept as ſtreight and ſmooth in the ſides, as is poſſible, there is then a kind of double *Wedge* to be made, and

fitted

fitted exactly for it; the ſhape whereof is to be ſeen in the annexed 3. Figure.

This double *Wedge*, being 12. or 13. Inches long, each piece of it, and ſo made, as being placed in their due poſition, they may make up a *Cylinder*, cut *Diagonal*-wiſe. The two flat ſides, that are contiguous, are to be greaſed or oyled, that the one may ſlip the more eaſily upon the other; and one of them, which is to be uppermoſt, having at the great end a hollow *Creaſe* dd cut into it round about, for faſtning a *Cartridge*, full of *Gunpowder*, to it with a thred, the round end of the *Wedge* being pared as much, as the thickneſs of the Paper or Paſtboard, that holds the Powder, needs to make the outſide thereof *even* with the reſt of the *Wedge*. This *Wedge* muſt have an Hole e drilled through the longeſt ſide of it, to be filled with *priming Powder*, for firing of the Powder in the *Cartridge*; which needs have no more, than half a pound of Powder, though upon occaſion a greater quantity may be uſed, as ſhall be found requiſite.

Then this *Wedge*, being firſt thruſt into the Hole with the *Cartridge*, the round ſide, where the Priming-hole is, being uppermoſt, the other *Wedge* ff is to be thruſt in, home to the due poſition, care being taken, that they fit the Hole in the Rock as exactly as may be. Then the end of the lower *Wedge* being gg about an Inch longer, than that of the upper outwardly, and flatned, priming Powder is to be laid upon it, and a piece of burning *Match* or *Thread* dipt in *Brimſtone* or other ſuch prepared combuſtible Matter, faſtned to it, that may burn ſo long, before it fire the Powder, as he, that orders it, may have time enough to retire quite out of the Pit or *Adit*, having firſt placed a piece of Wood or Iron ſo, as one end thereof, being ſet againſt the end of the lower Wedge, and the other againſt the ſide-wall, ſo as it cannot ſlip. Which being done, and the Man retired, when the Powder comes to take fire, it will firſt drive out the uppermoſt Wedge, as far as it will go; but the flaunting figure of it being ſo made, as the farther it goes backward, the thicker it grows, till at the laſt it can go no farther, then the fire

fire tears the Rock to get forth, and ſo crackes and breaks it all about, that at one time a vaſt deal of it will either be quite blown out, or ſo crackt and broken, as will make it eaſy to be remov'd: And according to the effect of one ſuch *Cartridge*, more may be afterwards made uſe of, as hath been ſaid.

Obſervables upon a Monſtrous Head.

This was the Head of a *Colt*, repreſented in the annexed *Figure* 4. firſt viewed by Mr. *Boyle*, who went into the Stable where the *Colt* lay, and got the Head haſtily and rudely cut off, the *Body* thereof appearing to his Eye compleatly formed, without any *Monſtroſity* to be taken notice of in it. Afterwards he cauſed it to be put into a Veſſel, and covered with *Spirit of Wine*, thereby chiefly intending, to give good example, together with a proof, that by the help of the ſaid *Spirit*, (which he hath recommended for ſuch Properties in one of his *Eſſays* of the *Uſefulneſs* of *Natural Philoſophy*) the parts of *Animals*, and even *Monſters*, may in *Summer* it ſelf be preſerved long enough, to afford *Anatomiſts* the opportunities of examining them.

The Head being opened, and examined, it was found,

Firſt, That it had no ſign of any *Noſe* in the uſual place, nor had it any, in any other place of the Head, unleſs the double Bagg CC, that grew out of the midſt of the forehead, were ſome rudiment of it.

Next, That the *two Eyes* were united into one *Double Eye*, which was placed juſt in the middle of the Brow, the Noſe being wanting, which ſhould have ſeparated them, whereby the two Eye-holes in the Scull were united into one very large round hole, into the midſt of which, from the Brain, entred one prety large *Optick Nerve*, at the end of which grew a great *Double Eye*; that is, that *Membrane*, called *Sclerotis*, which contained both, was one and the ſame, but ſeemed to have a *Seam*,

by

by which they were joined, to go quite round it, and the fore or pellucid part was distinctly separated into two *Cornea's* by a white *Seam* that divided them. Each *Cornea* seemed to have its *Iris*, (or Rain-bow-like Circle) and Apertures or Pupils distinct; and upon opening the *Cornea*, there was found within it two *Balls*, or *Crystalline Humours*, very well shaped; but the other parts of it could not be so well distinguished, because the eye had been much bruised by the handling, and the inner parts confused and dislocated. It had four Eye-browes, placed in the manner expreſt in Figure 4. by *a a*, *b b*; *a a* representing the *lower*, and *b b*, the *upper* Eyelids.

Lastly, That just above the Eyes, as it were in the midst of the Forehead, was a very deep depression, and out of the midst of that grew a kind of double *Purse* or *Bagg*, C C, containing little or nothing in it; but to some it seemed to be a production of the matter designed for the Nose, but diverted by this Monstrous Conception; perhaps the *Processus mammillares* joined into one, and covered with a thin hairy skin.

Observables in the Body of the Earl *of* Balcarres.

These following Observations, were a while since sent out of *Scotland* by an ingenious person, an Eye-witness, to Sir *Robert Moray*,

1. That the Belly of this Nobleman being opened, the *Omentum* or *Net* was found lean and small: his *Liver* very bigg; the *Spleen* bigg also, filled with a black and thick humour. His *Stomach* and *Entralls* all empty, of a Saffron-colour, distended with wind onely. The *Bladder* of *Gall* swelled with a black humour: the *Kidneys* filled with a kind of *grumous bloud*.

2. That in the *Thorax* or *Chest*, the *Lobes* of the *Lungs* were all entire, but of a bad colour; on the left side somewhat black and blue, and on the right, whitish; with a yellowish knob under one of the *Lobes*.

3. That

3. That the *Pericardium* or the *Caſe* of the *Heart* being opened, there appeared none of that water, in which the *Heart* uſes to ſwim; and the external Surface of it, from the *Baſe* to the *Tipp*, was not ſmooth, but very rough. It being cut aſunder, a quantity of white and inſpiſſate liquour run out, and beneath the *Baſe*, between the right and left Ventricle, *two ſtones* were found, whereof the one was as bigg as an *Almond*, the other, *two* Inches long and *one* broad, having three *Auricles* or criſped *Angles*: And in the Orifice of the right Ventricle, there was a fleſhy fattiſh Matter.

4. That the whole Body was bloudleſs, thin, and emaciated, of a black and bluiſh Colour.

5. The *Scull* being opened, both the *Cerebrum* and *Cerebellum* were bigg in proportion to the Body; and out of it run much more Bloud, than was ſeen in both the other Regions together.

Of the deſigned Progreſs to be made in the Breeding of Silkworms, *and the* Making *of* Silk, *in* France.

The *French* King *Henry the Fourth*, having made a general Eſtabliſhment all over *France*, of planting and propagating of *Mulberry-trees*, and *Breeding of Silkworms*, in order to ſet up and entertain a *Silktrade* there; and having proſpered ſo well in that Deſign, that in many parts of his Dominions great ſtore of ſuch Trees were raiſed, and Multitudes of Silk-works propagated, to the great benefit of the *French* people, foraſmuch as it was a conſiderable beginning to avoid the tranſport of ſeveral Millions abroad for buying of Silks, and withall an excellent means of well-imploying abundance of poor Orphans and Widows, and many old, lame, and other indigent and helpleſs people; The preſent *French King*, hath lately revived and ſeconded that Undertaking, by giving expreſs order, that it ſhould be promoted by all poſſible means, and particularly in the *Metropolis* of that Kingdom, and round about it; and that for that end the whole way concerning that Work and

Trade ſhould be fully and punctually communicated in Print; which hath alſo been executed by one *Monſieur Iſnard*, in a Treatiſe publiſhed at *Paris*, in *French*, Intitled, *Inſtructions for the Planting of White Mulberryes, the Breeding of Silkworms, and the Ordering of Silk in* Paris, *and the circumjacent Places*. In which Book, the Method being repreſented, which that Great Prince *Henry* IV. uſed in eſtabliſhing the ſaid Work and Trade, together with the ſucceſs thereof, and the advantages thence derived to his Subjects, the *Author*, from his own *Experience*, and long *Practice*, delivers (and ſeems to do it candidly) all what belongs in this buſineſs in four main heads. *Firſt*, he teaches the Means of ſowing, planting, and raiſing *White Mulberryes* (as the Foundation of Silkworks) ſhewing how many ſeveral wayes *that* may be done. *Secondly*, The Breeding of *Silkworms*, the chooſing of good Eggs, and their hatching, as alſo the Feeding of the *Worms*, and preſerving them from Sickneſs, and Curing them of it, together with the way of making them ſpin to beſt advantage. *Thirdly*, The manner of winding their Silk from their Bottoms, adding the *ſcheme* of the *Inſtrument* ſerving for that purpoſe. *Fourthly*, The way of *keeping Silkworms* Eggs for the enſuing year.

Through the whole Book are ſcattered many not inconſiderable particulars, though perhaps known to moſt. The *White Mulberry Tree*, as it is in other qualities preferable to the *Black*, ſo this *Author* eſteems it the beſt, not onely for the durableneſs of the wood, and its large extent of uſefulneſs in Carpentry and Joyners work; but alſo for the fitneſs of its leaves (beſides their principal uſe for the food of *Silkworms*) to fatten Sheep, Goats, Cowes, and Hoggs, only by boyling and mingling them with Bran. The Berryes themſelves he commends as very excellent to fatten Poultry, and to make them lay Eggs plentifully. In the *Changes*, *Working*, and *Generation* of this *Inſect*, he is very curious to obſerve many things. Their *Metamorphoſes*, as is known, are four, whereof the form of the one hath no conformity with any of the reſt. The firſt from an Egge (of the bigneſs of a Muſtard-ſeed, and of a darkiſh Gray Colour, when good) to a *Worm* or *Caterpillar*, but of a domeſtick, noble, and profitable kind; *Black*, when it firſt comes forth

forth, but growing *white* at laſt; having 24. feet, 8. on each ſide of the body, and 4. beſides, cloſe to each ſide of the head. During this form, they undergo conſtantly 4. Sickneſſes, in which they caſt their Skins, each ſickneſs laſting about 4. days, wherein they feed not at all; but grow clearer, ſhorter, and thicker. The ſecond, from a *Worm* to an *Aurelia* or *Chryſalis*, having the ſhape of a ſmall Plum, whereunto it is transformed after its ſpinning time is paſt; in which ſtate it lyes ſhut up, in hot Countries, for 14. or 15. dayes; in more temperate ones, 18. or 20. without any Food or Air, known to us. During which time this *Inſect* leaves two Coats, both that of a *Worm*, whence 'tis changed into an *Aurelia*, and that of an *Aurelia*, whence it becomes a *Papilio* or *Butterfly*, in the *Theca* or *Caſe*. The third is, from an *Aurelia* to a *Butterfly*, coming out of the *Theca* with a head, leggs, and horns; for which paſſage it makes way by a whitiſh water, it caſts upon the Silk, which moiſtning, and thereby in a manner putrefying it, the new creature thruſts out its head through the ſharp end of the *Caſe*, by a Hole as big as its ſelf. There is found no Excrement in the *Caſe*, but the two Skins onely, juſt now mentioned.

Before they begin to ſpin, and about the latter end of their feeding, they muſt, ſaith the *Author*, be often changed, and have Air enough, by opening the Windows of the Room, they are in, if it be not too ill Weather; elſe, ſaith he, the Silk that is in their Belly, will cauſe ſo extrordinary a heat in them, that it burns their gutts, and ſometimes burſts them; and the ſame (being a ſubſtance that reſembleth Gum or Burgundy Pitch) will putrefy and turn into a yellowiſh matter.

He maketh the beſt marks of their maturity for ſpinning to be, when they begin to quit their white Colour, and their green and yellow Circles, and grow of the Colour of Fleſh, eſpecially upon the tail; having a kind of *conſiſtent* ſoftneſs, ſhewing that they have ſomething ſubſtantial in their Stomachs.

As for their *Working*, he gives this account of it, that the firſt day they make only a *Webb*; the ſecond, they form in this *Webb* their *Caſes*, and cover themſelves all over with Silk; the third day, they are no longer ſeen, and the dayes following they thicken their *Caſes*, alwayes by one *end* or *thread*, which they

never break off, themſelves. This, he affirms, they put out with ſo much quickneſs, and draw it ſo ſubtle and ſo long, that, without an *Hyperbole*, the *end* or *thread* of every *Caſe* may have two Leagues in length. He advertiſeth, that they muſt be by no means interrupted in their work, to the end, that all the Silk, they have in their bellyes, may come out.

Some eight dayes after they have finiſhed their Work, as many of the beſt *Caſes*, as are to ſerve for *ſeed*, *viz.* the firſt done, the hardeſt, the reddeſt and beſt coloured, muſt be choſen, and put a-part; and all diligence is to be uſed to winde off the ſilk with as much ſpeed, as may be, eſpecially if the *Worms* have nimbly diſpatched their work.

Here he ſpends a good part of his Book, in giving very particular Inſtructions, concerning the way of winding off the ſilk, ſetting alſo down the form of the Oven and Inſtruments neceſſary for that work, which is the painfulleſt and niceſt of all the reſt.

Touching their *Generation*, he preſcribeth that there be choſen as many male as female *Caſes* (which are diſcerned by this, that the males are more pointed at both ends of the *Caſes*, and the females more obtuſe on the ends, and bigger-bellyed) and that care be had, that no *Caſes* be taken, but ſuch wherein the *Worms* are heard rolling; which done, and they being come forth in the form of *Butterflyes*, having four wings, ſix feet, two horns, and two very black eyes, and put in a convenient place, the males fluttering with their wings, will joyn and couple with the females, after that theſe have firſt purged themſelves of a kind of reddiſh humour by the fundament: in which poſture they are to be left from Morning (which is the ordinary time of their coming forth) till evening, and then the females are to be gently pulled away, whereupon they will lay their eggs, having firſt let fall by the Fundament another humour, eſteemed to proceed from the ſeed of the males; but the males are then thrown away as uſeleſs. He advertiſeth, that if they be coupled longer then 9. or 10. hours, (which they will be, and that ſometimes for 24. hours together, if they be let alone) either the female will receive very great hurt by it, or much ſeed will remain in her belly.

The

The ſeed at firſt coming out is very white, but within a day it becoms greeniſh, then red, at laſt by little and little gray, which colour it retains alwaies, the moſt coloured of an obſcure gray, being the beſt; thoſe grains, which never quit their whiteneſs, having no fecundity in them.

Each female emits ordinarily ſome 300. grains, more or leſs, ſome of them not being able to render them all, and dying with them in their belly. One ounce of ſeed will require an hundred pair of *Caſes*, of as many Males as Females.

Care muſt be taken, that no Rats, Mice, Ants, or other Vermin, nor any Hens, or Birds come neer the Seed, they being very greedy to eat them.

This is the ſubſtance of what is contained in this *French* Author, publiſhed at *Paris* on purpoſe to promote the *Making* of *Silk* there, as well as it is practiſed already in other parts of that Kingdom: which is repreſented here, to the end, that from this occaſion the deſign, which the Engliſh Nation once did entertain of the *increaſing of Mulberry-trees*, and the *Breeding of Silk-worms*, for the *making of Silk* within themſelves, may be renewed, and *that* encouragement, given by King *James* of Glorious memory for that purpoſe (witneſs that *Letter* which he directed to the Lords Lieutenants of the ſeveral ſhires of *England*) and ſeconded by his *Moſt Excellent Majeſty*, that now is, be made uſe of, for the honour of *England* and *Virginia*, and the increaſe of wealth to the people thereof: eſpecially ſince there is cauſe of hope, that a *double Silk-harveſt* may be made in *one* Summer in *Virginia*, without hindring in the leaſt the *Tobacco*-Trade of that Countrey.

Enquiries concerning Agriculture.

Whereas the *Royal Society*, in proſecuting the *Improvements of Natural knowledg*, have it in deſign, to collect *Hiſtories of Nature and Arts*, and for that purpoſe have already, according to the ſeveral Inclinations and Studies of their Members, divided themſelves into divers *Committees*, to execute the ſaid deſign: Thoſe Gentlemen, which do conſtitute the *Committee* for conſidering of *Agriculture*, and the *Hiſtory* and *Improvement* thereof, have begun their work with drawing up certain Heads

Heads of *Enquiries*, to be distributed to persons *Experienced in Husbandry* all over *England*, *Scotland*, and *Ireland*, for the procuring a *faithful* and *solid* information of the *knowledg* and *practice* already obtained and used in these Kingdoms; whereby, besides the aid which by this means will be given to the general End of collecting the aforementioned *History*, every place will be advantaged by the helps, that are found in any, and occasion ministred to consider, what improvements may be further made in this whole matter. Now to the End, that those *Enquiries* may be the more universally known, and those who are skilful in Husbandry, publickly invited to impart their knowledg herein, for the *common* benefit of their Countrey, it hath been thought fit to publish the *effect* of them in Print, and withall to desire, that what such persons shall think good from their own *Knowledg* and *Experience* to communicate hereupon, they would be pleased to send it to the Printers of the *Royal Society*, to be delivered to either of the *Secretaries* of the same. The Enquiries follow.

1. For *Arable*.

1. The several kinds of the soyls of *England*, being supposed to be, either Sandy, Gravelly, Stony, Clayie, Chalky, Light-mould, Heathy, Marish, Boggy, Fenny, or Cold weeping Ground; information is desired, what kind of soyls your Country doth most abound with, and how each of them is prepared, when employed for *Arable*?

2. What *peculiar* preparations are made use of to these Soyls for each kind of Grain; with what kind of Manure they are prepared; when, how, & in what quantity the Manure is laid on?

3. At what seasons and how often they are ploughed; what kind of Ploughs are used for several sorts of Ground?

4. How long the several Grounds are let ly fallow?

5. How, and for what productions, *Heathy* Grounds may be improved? And who they are (if there be any in your Country) that have reduced *Heaths* into profitable Lands?

6. What ground *Marle* hath over head? How deep generally it lieth from the surface? What is the depth of the *Marle* it self? What the colour of it? Upon what grounds it is used?

What

What time of the year it is to be laid on? How many loads to an Acre? What Grains *Marled* Land will bear, and how many years together? How ſuch *Marled* Land is to be uſed afterwards, *&c?*

7. The kinds of Grain or Seed, uſual in *England*, being ſuppoſed to be either Wheat, Miſcelane, Rye, Barley, Oats, Peaſe, Beans, Fitches, Buck-wheat, Hemp, Flax, Rape; We deſire to know, what ſorts of Grains are ſown in your Country, and how each of theſe is prepared for Sowing? Whether by *ſteeping*, and in what kind of Liquor? Or by mixing it, and with what?

8. There being many ſorts of Wheat, as the White or Red Lammas, the bearded Kentiſh Wheat, the gray Wheat, the red or gray Pollard, the Ducks-bill Wheat, the red-eared-bearded Wheat, *&c.* And ſo of Oats, as the common Black, Blue, Naked, Bearded in *North-wales*: and the like of Barley, Peaſe, Beans, *&c.* The Enquiry is, which of theſe grow in your Country, and in what Soyl; and which of them thrive beſt there; and whether each of them require a peculiar Tillage; and how they differ in goodneſs?

9. What are the chief particulars obſervable in the choice of Seed-corn, and all kinds of Grain; and what kinds of Grain are moſt proper to ſucceed one another?

10. What Quantity of each kind is ſown upon the Statute-Acre? And in what ſeaſon of the Moon and year 'tis ſowed?

11. With what inſtruments they do Harrow, Clod and Rowl, and at what ſeaſons?

12. How much an Acre of good Corn, well ordered, generally uſeth to yield, in very good, in leſs good, and in the worſt years?

13. Some of the common Accidents and Diſeaſes befalling Corn in the growth of it, being Meldew, Blaſting, Smut; what are conceived to be the Cauſes thereof, & what the Remedies?

14. There being other Annoyances, the growing Corn is expoſed to, as Weeds, Worms, Flies, Birds, Mice, Moles, *&c.* how they are remedied?

15. Upon what occaſions they uſe to cut the young Corn in the Blade, or to feed it; and what are the benefits thereof?

16. VVhat are the ſeaſons and waies of Reaping and Ordering each ſort of Grain, before it be carried off the Ground?

17. VVhat

17. VVhat are the ſeveral waies of preſerving Grain in the Straw, within and without doors, from all kind of Annoyance, as Mice, Heating, Rain, *&c?*

18. VVhat are the waies of ſeparating the ſeveral ſorts of Grain from the Straw, and of dreſſing them?

19. VVhat are the waies of preſerving any ſtores of ſeparated Grain, from the Annoyances they are obnoxious to?

2. For *Meadows.*

1. How the above-mentioned ſorts of Soyl are prepared, when they are uſed for Paſture or Meadow?

2. The common Annoyances of theſe Paſture or Meadow Grounds being ſuppoſed to be, either Weeds, Moſs, Sourgraſs, Heath, Fern, Buſhes, Bryars, Brambles, Broom, Ruſhes, Sedges, Gorſe or Furzes; what are the Remedies thereof?

3. VVhat are the beſt waies of Drayning Marſhes, Boggs, Fenns, *&c?*

4. VVhat are the ſeveral kinds of Graſs, and which are counted the beſt?

5. VVhat are the chief circumſtances obſervable in the Cutting of Graſs; and what in the making and preſerving of Hay?

6. VVhat kind of Graſs is fitteſt to be preſerved for winter-feeding? And what Graſs is beſt for Sheep, for Cows, Oxen, Horſes, Goats, *&c.*

Advertiſement.

The Reader *is hereby advertiſed, that by reaſon of the preſent Contagion in* London, *which may unhappily cauſe an interruption aſwel of* Correſpondencies, *as of* Publick Meetings, *the printing of theſe* Philoſophical Tranſactions *may poſſibly for a while be intermitted; though endeavors ſhall be uſed to continue them, if it may be.*

LONDON,

Printed with Licence, By *John Martyn*, and *James Allestry*, Printers to the *Royal-Society*, at the *Bell* in St. *Pauls Church-Yard.* 1665.

PHILOSOPHICAL TRANSACTIONS.

Monday, *Novemb.* 6. 1665.

The Contents.

An Account of a not ordinary Burning Concave, *lately made at* Lyons, *and compared with ſeveral others made formerly. Of Monſieur* Hevelius *his promiſe of communicating to the World his Invention of making* Optick Glaſſes; *and of the hopes, given by Monſieur* Chriſtian Hugens *of* Zulichem, *to perform ſomething of the like nature; as alſo of the Expectations, conceived of ſome Perſons in* England, *to improve* Teleſcopes. *An Intimation of a way of making more lively Counterfeits of Nature in* Wax, *then are extant in* Painting; *and of a new kinde of* Maps *in a low* Relievo, *or Sculpture, both practiſed in* France. *Some* Anatomical *Obſervations, of Milk found in Veins inſtead of Blood; and of Graſs, found in the Wind-pipes of ſome Animals. Of a place in* England, *where, without petrifying Water, Wood is turn'd into Stone. Of the nature of a certain Stone, found in the* Indies *in the head of a* Serpent. *Of the way, uſed in the* Mogol's *Dominions, to make* Salt-petre. *An Account of* Hevelius *his* Prodromus Cometicus, *and of ſome Animadverſions made upon it by a* French *Philoſopher; as alſo of the Jeſuit* Kircher's Mundus Subterraneus.

An Account of a not ordinary Burning Concave, *lately made at* Lyons, *and compared with ſeveral others made formerly.*

AN opportunity being preſented to revive the publiſhing of theſe Papers, which for ſome Moneths hath been

 diſcontinued

diſcontinued by reaſon of the great Mortality in *London*, where they were begun to be Printed; it hath been thought fit to embrace the ſame, and to make uſe thereof for the gratifying of the Curious, that have been pleaſed to think well of ſuch Communications: To re-enter whereupon, there offers it ſelf firſt of all a Relation of an un-common *Burning Glaſs*, not long ſince made in *France*, in the City of *Lyons*, by one called Monſieur *de Vilette*, as it was ſent to the *Publiſher* of theſe *Tracts*, in two Letters, whereof the one was in *Latine*, the other in *French*, to this effect:

Concerning the Efficacy of Monſieur *de Vilette* his Burning Glaſs, all what the *P. Bertet* hath written of it, is true. We have ſeen the Effects of it repeated over and over again, in the Morning, at Noon, and in the After-noon, always performing very powerfully; burning or melting any Matter, very few excepted. The *Figure* of it is round, being thirty Inches, and ſomewhat better, in *Diameter*. On one ſide it hath a Frame of a circle of Steel, to the end that it may keep its juſt Meaſure: 'Tis eaſie to remove it from place to place, though it be above an hundred weight, and 'tis eaſily put in all ſorts of poſtures. The *burning Point* is diſtant from the Centre of the Glaſs, about three Feet. The *Focus* is about half a *Louys d'or* large. One may paſs ones hand through it, if it be done nimbly; for if it ſtay there the time of a ſecond Minute, there is danger of receiving much hurt.

Green wood takes fire in it, in an inſtant, as do alſo many other Bodies.

	Seconds.
A ſmall piece of *Pot-Iron* was melted, and ready to drop down, in	40.
A *Silver Piece of* 15 *Pence* was pierced, in	24.
A *groſs Nail* (called *le Clou de paiſan*) was melted, in	30.
The end of a *Sword-blade of Olinde*, was burn'd, in	43.
A *Braſs Counter* was pierced, in	05.
A piece of *red Copper* was melted, ready to drop down, in	42.

A piece

A piece of a *Chamber Quarry-ſtone* was vitrified, and put into a Glaſs-drop, in	*ſec.* 45.
Steel, whereof Watch-makers make their ſprings, was found melted, in	09.
A *Mineral-ſtone*, ſuch as is uſed in Harquebuſſes *à rouët*, was calcin'd and vitrified, in	1. *juſt.*
A piece of *Morter* was vitrified, in	52.

In ſhort, there is hardly any Body, which is not deſtroyed by this Fire. If one would melt by it any great quantity of Mettal, that would require much time, the Action of Burning not being perform'd but within the bigneſs of the *Focus*, ſo that ordinarily none but ſmall pieces are expoſed to it. One Monſieur *d'Alibert* buys it, paying for it Fifteen hundred Livres.

Since this Information, there were, upon occaſion given from hence, upon the ſame ſubject, further communicated from *Paris* the following Particulars:

I ſee by two of the Letters, that you incline to believe, the Glaſſes of *Magnus* and *Septalius* do approach to that of *Lyons*: But I can aſſure you, they come very far ſhort of it. You may conſult *Magnus* his Book, where he deſcribes his; and there are ſome Perſons here that have ſeen one of his beſt, which had but about twenty Inches *diameter*; ſo that this of *Lyons* muſt perform at leaſt twice as much. As to *Septalius*, we expect the Relations of it from Intelligent and Impartial Men. It cannot well be compared to that of *Lyons*, but in bigneſs; and in this caſe, if it have five *Palms* (as you ſay) that would be about 3½ feet *French*, and ſo it were a Foot bigger, which would make it half as much greater in ſurface: But as to the Effects, ſeeing it burns ſo far off, they cannot be very violent. And I have heard one ſay, that had ſeen it, that it did not ſet Wood on Fire but after the time of ſaying a *Miſerere*. You may judge of the difference of the Effects, ſince that of *Lyons* gathers its Beams together within the ſpace of ſeven or eight *Lines*;

and that of *Septalius* muſt ſcatter them in the compaſs of three Inches. Some here do intend to make of them, yea and bigger ones; but we muſt ſtay till they be done, *&c.*

Of Monſieur Hevelius's *Promiſe of imparting to the World his Invention of making* Optick Glaſſes; *and of the hopes given by Monſieur* Hugens *of* Zulichem, *to perform ſomething of the like nature; as alſo of the Expectations, conceived of ſome Ingenious Perſons in* England, *to improve* Teleſcopes.

That eminent Aſtronomer of *Dantzick*, Monſieur *Hevelius*, writes to his Correſpondent in *London*, as followeth:

What hath been done in the grinding of Optick glaſſes in your parts, and how thoſe beginnings, mention'd by you formerly, do continue and ſucceed, I very much covet to hear. 'Tis now above ten Years, ſince I my ſelf invented a peculiar way of grinding ſuch Glaſſes, and reduced it alſo into practiſe; by which 'tis eaſie, without any conſiderable danger of failing, to make and polliſh Optick glaſſes of any *Conick* Section, and that (which is moſt notable) in any diſh of any Section of a *Sphere*: which Invention I have as yet diſcovered to none, my purpoſe being, for the Improvement of Natural Knowledge, to deſcribe the whole method thereof in my *Celeſtial Machine*, and to propoſe it to the Examination and Judgement of the *Royal Society*; not doubting at all, but they will finde the way true and practicable, my ſelf having already made ſeveral Glaſſes by it, which many Learned Men have ſeen and tryed.

Monſieur *Hugens*, inquiring alſo in a Letter, newly written by him to a Friend of his in *England*, of the ſucceſs of the attempts made by an Ingenious *Engliſh* Man for perfecting ſuch Glaſſes, and urging the proſecution of the ſame,

ſo

ſo as to ſhew by the Effects the practicableneſs of the Invention, mentions thereupon, That he intends very ſhortly to try ſomething in that kinde, of the ſucceſs whereof he declares to have good hopes.

Monſieur *du Son*, that excellent Mechanician, doth alſo at this very preſent employ himſelf in *London*, to bring *Teleſcopes* to perfection, by grinding Glaſſes of a *Parabolical* Figure, by the means whereof he hopes to enable the Curious to diſcover more by a Tube of one Foot long, or thereabout, furniſhed with Glaſſes thus figured, then can be done by any other Tubes of very many times more that length: The ſucceſs hereof will (its thought) ſhortly appear.

An Advertiſement of a way of making more lively Counterfaits of Nature in Wax, *then are extant in* Painting: *And of a new kinde of* Maps *in a low* Relievo. *Both practiſed in* France.

This was communicated by the Ingenious Mr. *John Evelyn*, to whom it was ſent from *Paris* in a Letter, as followeth:

Here is in our Neighbourhood a *French-man*, who makes more lively Counterfeits of Nature in *Wax*, then ever I yet ſaw in *Painting*, having an extraordinary addreſs in modelling the Figures, and in mixing the Colours and Shadows; making the Eyes ſo lively, that they kill all things of this Art I ever beheld: He pretends to make a viſit into *England* with ſome of his Pieces.

I have alſo ſeen a new kinde of *Maps* in low *Relievo*, or Sculpture: For example, the Iſle of *Antibe*, upon a ſquare of about eight Foot, made of Boards, with a Frame like a Picture: There is repreſented the Sea, with Ships and other Veſſels Artificially made, with their *Canons* and Tackle of Wood fixed upon the ſurface, after a new and moſt admirable manner. The Rocks about the Iſland exactly form'd,

as

as they are upon the Natural Place; and the Island it self, with all its Inequalities, and Hills and Dales; the Town, the Fort, the little Houses, Platform, and Canons mounted; and even the Gardens and Platforms of Trees, with their green Leaves standing upright, as if they were growing in their Natural Colours: In *fine*, Men, Beasts, and whatever you may imagine to have any protuberancy above the level of the Sea. This new, delightful, and most instructive form of *Map*, or *Wooden Country*, you are to look upon either *Horizontally*, or *sidelong*, and it affords equally a very pleasant object.

Some Anatomical *Observations of Milk found in Veins, instead of Blood; and of Grass, found in the Wind-pipes of some* Animals.

A curious Person wrote not long since from *Paris*, that there they had, in the House of a Physician, newly open'd a Mans Vein, wherein they found *Milk*, instead of *Blood*. This being imparted to Mr. *Boyle* at *Oxford*, his Answer was, That the like Observation about *white Blood*, had been made by a Learned Physician of his acquaintance, and the thing being by him look'd upon as remarkable, he was desirous to have it very circumstantially from the said Physitian himself, before he would say more of it. The next Moneth may bring us in this Account.

The other Particular, mention'd in the Title of this Head, came in a Letter, sent also by Mr. *Boyle*, in these words:

I shall acquaint you, That two very Ingenious Men, Dr. *Clark*, and Dr. *Lower*, were pleas'd to give me an account of a pretty odde kinde of Observation: One of them assuring me, That he had several times, in the Lungs of *Sheep*, found considerable quantity of Grass in the very Branches of the *Aspera Arteria*: And the other relating to me, That a few Weeks since, He, and a couple of Physicians,

tians, were invited to look upon an *Ox*, that had for two or three days almoſt continually held his Neck ſtreight up, and was dead of a Diſeaſe, the Owner could not conjecture at; whereupon, the parts belonging to the Neck and Throat, being open'd, they found, to their wonder, the *Aſpera Arteria* in its very Trunk all ſtuff'd with Graſs, as if it had been thruſt there by main force: which gives a juſt cauſe of marvelling and inquiring, both how ſuch a quantity of Graſs ſhould get in there; and how, being there, ſuch an Animal could live with it ſo long.

Of a place in England, *where, without petrifying Water, Wood is turned into Stone.*

The ſame Searcher of Nature, that was alledged in the immediately precedent Obſervations, did impart alſo the following, in another Letter from *Oxford*, where he ſaith:

I was a while ſince viſited by a Gentleman, who tells me, That he met with a Place in theſe parts of *England*, where, though there be no petrefying Spring (for that I particularly asked) Wood is turned into Stone in the *Sandy Earth* it ſelf, after a better manner then by any Water I have yet ſeen: For I had the Curioſity to go to look upon pieces of Wood, he brought thence, and hope for the opportunity of making ſome tryals to examine the matter a little further, then I have yet been able to do. *Thus far that Letter.*

Since which time, He was pleaſed to give this further Information of the ſame matter, with a *Mantiſſa* of ſome other Particulars, belonging to this Subject, in theſe Words.

I was lately making ſome Tryals with the petrifyed Wood I told you off, which I finde to be a very odde ſubſtance, wonderfully hard and fixed. If I had opportunity to Re-print the *Hiſtory of Fluidity* and *Firmneſs*, I could adde divers things about *Stones*, that perhaps would not be diſliked; and I hope, if God vouchſafe me a little leiſure,

to

to inſert ſeveral of them in fit places of that *Hiſtory*, againſt the next *Edition*. Here is a certain Stone, that is thought to be petrifyed Bone, being ſhap'd like a Bone, with the Marrow taken out; but with a fit *Menſtruum*, I found that I could eaſily diſſolve it, like other ſoft Stones: and poſſibly it may prove as fit as *Oſteocolla*, for the ſame Medicinal Uſes.

Of the nature of a certain Stone, found in the Indies, *in the head of a* Serpent.

There was, ſome while ago, ſent by Sir *Philiberto Vernatti* from *Java major*, where he reſides, to Sir *Robert Moray*, for the Repoſitory of the *Royal Society*, a certain Stone, affirmed by the Preſenter to be found in the Head of a *Snake*, which laid upon any Wound, made by any venomous Creature, is ſaid to ſtick to it, and to draw away all Poyſon: and then, being put in Milk, to void its Poyſon therein, and to make the Milk turn blew; in which manner it muſt be uſed, till the Wound be cleanſed.

The like Relations having been made, by ſeveral others, of ſuch a Stone, and ſome alſo in this City affirming, to have made the Experiment with ſucceſs, it was thought worth while, to inquire further into the truth of this Matter: ſince which time, nothing hath been met with but an Information, delivered by that Ingenious *Pariſian*, Monſieur *Thevenot*, in his ſecond *Tome*, of the *Relations of divers conſiderable Voyages*, whereof he lately preſented ſome Exemplars to his Friends in *England*. The Book being in French, and not common, 'tis conceived it will not be amiſs to inſert here the ſaid Information, which is to this effect:

In the *Eaſt Indies*, and in the Kingdom of *Quamſy* in *China*, there is found a Stone in the Head of certain *Serpents* (which they call by a name ſignifying *Hairy Serpents*) which heals the bitings of the ſame Serpent, that elſe would kill in 24 hours. This Stone is round, white in the middle, and about the edges

edges blew or greeniſh. Being applyed to the Wound, it adheres to it of it ſelf, and falls not off, but after it hath ſucked the Poyſon: Then they waſh it in Milk, wherein 'tis left awhile, till it return to its natural condition. It is a rare Stone, for if it be put the ſecond time upon the Wound, and ſtick to it, 'tis a ſign it had not ſuck'd all the Venome during its firſt application; but if it ſtick not, 'tis a mark that all the Poyſon was drawn out at firſt. So far our *French* Author: wherein appears no conſiderable difference from the written Relation before mentioned.

Of the way, uſed in the Mogol's *Dominions, to make* Saltpetre.

This is delivered in the ſame Book of Monſieur *Thevenot*, and the manner of it having been inquired after, by ſeveral curious Perſons, to compare it with that which is uſed in *Europe*, 'tis preſum'd, they will not be diſpleaſed to finde it inſerted here in *Engliſh*, which is as followeth:

Saltpetre is found in many places of the *Eaſt Indies*, but chiefly about *Agra*, and in the Villages, that heretofore have been numerouſly inhabited, but are now deſerted. They draw it out of three ſorts of Earth, black, yellow, and white: the beſt, is that which is drawn out of the black, for it is free from *common* Salt. They work it in this manner: They make two Pits, flat at the bottom, like thoſe wherein common Salt is made; one of them having much more compaſs then the other, they fill *that* with Earth, upon which they let run Water, and by the feet of People they tread it, and reduce it to the conſiſtency of a Pap, and ſo they let it ſtand for two days, that the Water may extract all the Salt that is in the Earth: Then they paſs this Water into another Pit, in which it chriſtallizes into *Saltpetre*. They let it boil once or twice in a Caldron, according as they will have it whiter and purer. Whilſt it is over the Fire, they ſcum it continually, and fill it out into great Earthen Pots, which

hold each 25 or 30 pounds, and theſe they expoſe to clear Nights; and if there be any impurity remaining, it will fall to the bottom: Afterwards they break the Pots, and dry the Salt in the Sun. One might make vaſt quantities of Saltpetre in theſe parts; but the Country People ſeeing that *We* buy of it, and that the *Engliſh* begin to do the ſame, they now ſell us a *Maon* of 6 pounds for two *Rupias* and a half, which we had formerly for half that price.

An Account of Hevelius *his* Prodromus Cometicus, *together with ſome Animadverſions made upon it by a* French *Philoſopher.*

This excellent *Dantiſcan* Aſtronomer, *Hevelius*, in his *Prodromus* (by him ſo call'd, becauſe it is as a Harbinger to his *Cometography*, which hath already ſo far paſſed the Preſs, that of twelve Books there are but three remaining to be Printed) gives an Account of the Obſervations he hath made of the *Firſt* of the two late Comets; reſerving thoſe he hath made of the *ſecond*, for that great Treatiſe, where he alſo intends to deliver the Matter of this *firſt* more particularly and more fully then he hath done here.

In this Account he repreſents the Riſe, Place, Courſe, Swiftneſs, Faces and Train of this Comet, interweaving his Conceptions both about the Region of Comets in general (whether it be the *Air*, or the *Æther*?) and the Cauſes of their Generation: In the ſearch of which latter, he intimates to have received much aſſiſtance from his *Teleſcope*.

He obſerved this Comet not before *Decemb.* $\frac{4}{14}$, (though he conceives it might have been ſeen ſince *Novem.* 23. *ſt. n*) & he ſaw it no longer then *Febr.* $\frac{8}{18}$: though ſeveral others have ſeen it both ſooner, and later: and though himſelf continued to look out for it till *March* 7. *ſt. n.* but fruitleſly, whereof he thinks the reaſon to have been its too great diſtance and tenuity.

He

He finds, its apparent Motion was not made in a *Juſt* great Circle, but deviating conſiderably from it; and conceives, that every Comet falls to this deviation, when this apparent Motion grows ſlow, and the Star becomes Stationary (which, as he ſaith, it doth in reſpect of the *Ecliptick*, not its own *Orbite*.) Here he obſerves, That from *Decemb.* $\frac{8}{18}$ to *Decem.* 30. *Jan.* 9. its courſe was almoſt in a great Circle: but, that *then* it began to deflect from that Circle towards the *North*; ſo that afterwards, with a very notable and conſpicuous Curvity, it directed its courſe towards *Primam Arietis*: Of which deflection, he ventures to aſſign the cauſe from the Cometical Matter, the various poſition and diſtance of the Comet from the Earth and the Sun, the annual Motion of the Earth, and the impreſſed Motion, and the inclination of the *diſcus* of the Cometical Body.

He is pretty poſitive, that without the *annual Motion* of the *Earth*, no rational Account can be given of any Comet, but that all is involved with perplexities, and deform'd by abſurdities.

He inquires, ſince all Comets have their peculiar *Ingenite* Motion, what kinde of Line it is, they deſcribe by that Motion of their own? whether circular, or ſtreight, or curve, or partly ſtreight and partly curve? And if curve, whether regular or irregular? if regular, whether Elliptick, or Parabolar, or Hyperbolical? He anſwers, That this Motion is *Conical*; and judgeth, that by the *Conick* path all the *Phænomena* of Comets can, without any inconveniency, be readily ſolved; even of that, which (by Hiſtory) in fifty days, paſſed through more then the 12 Signs of the *Zodiack*: And of that, which in two days run through eight Signs: and of another, which in 48 days poſted through all the Signs, *contra ſeriem*. Which how it can be explicated upon the ſuppoſition of the Earths ſtanding ſtill, and upon the denying of the annual Motion thereof, he underſtands not at all.

He refers to his *Cometography* theſe Diſquiſitions: whether all Comets (in their innate Motion) move equal *Spaces* in equal *Times?* which is the ſwifteſt, and which the floweſt Motion they are capable of? what the cauſe of this acceleration and retardation of their true Motion?

He puts it out of doubt, that they are in the *Sky* it ſelf, producing Reaſons for it that are very conſiderable, and alledging among others, That the *Parallaxes* doe clearly evince it, which he finds far leſs in Comets, then in the *Moon*, yea then ſometimes in the *Sun* it ſelf. Where he alſo repreſents, That he harh deduced the *Horizontal Parallax* of this very Comet from one onely Obſervation, made *Febr*: 4. *ſt.n.* by which he found, That then it was diſtant from the Earth 5000 Semidiameters of the ſame, or 4300000 *German* miles. From this its diſtant from the earth, he deduces, That on that Day when it was ſo remote from the Earth, its true *Diameter* was 2560 *German* miles, which is three times bigger then the Diameter of the Earth, and almoſt ſix times bigger then that of the Moon, whoſe Diameter, according to his *Theory*, is 442 *German* miles.

He finds the *Matter* of Comets to be in the *Æther* it ſelf, making the *Æther* and the *Air* to differ onely in purity, and eſteeming, That the *Planets* do emit their Exhalations, and have their *Atmoſpheres* like unto our Earth. Where he affirms, That the Sun alone may caſt out ſo much Matter at any time in one Year, as that thence ſhall be produced not one or two Comets, equalling the Moon in Diameter, but very many; which if ſo, what contribution may not be expected from the other Planets?

Of this Cometical Matter, he thinks, That firſt it is by little and little gathered together, then coagulated and condenſed, and thereby reduced to a leſs Diameter; but then, after a while, it reſolves again, and grows dilute and pale, and at laſt is diſſipated. And accordingly he affirms, That he hath obſerved the Head of this Comet at firſt more confuſed, thin and pale, afterwards clearer and clearer.

He

He conceives, That all Comets do reſpect the *Sun* as their *King* and *Centre*, as *Planets* do, making them a kinde of *Spurious Planets*, that emulate the *true* ones in their Motion almoſt in all things.

The *Train*, he makes nothing elſe but the Beams of the Sun, falling on the head of the Comet, and paſſing through the ſame, refracted and reflected. And amongſt his *Obſervations* and *Schemes* of this Comet, there occurs one, wherein the Tail is *curve*, ſo ſeen by him *Decemb.* $\frac{11}{21}$. He aſſigns the cauſes why the Trains do ſo much vary, and ſhews alſo, on what depends their length.

Whether *the ſame* Comets return again, as the Spots in the Sun? and, Whether in the time of great *Conjunctions* they are more eaſily generated? and whether they can be certainly foretold? with ſeveral other Inquiries, he refers for to his *great Book*.

As to *Prognoſtications*, he ſomewhat complains, That Men do more inquire what Comets *ſignifie*, then what they *are*, or how they are generated and moved; profeſſing himſelf to be of the minde of thoſe that would have Comets rather *admired* then *feared*; there appearing indeed no cogent reaſon, why the Author of Nature may not intend them rather as Monitors of his *Glory* and *Greatneſs*, then of his *Anger* or *Diſpleaſure*; eſpecially ſeeing that ſome very diligent Men (among whom is *Gemma Friſius*) take notice of as great a number of *good* as *bad* Events, conſequent to Comets. *Seneca* alſo relating, That that Comet which appeared in his Time, was ſo happy, that it did *Cometis detrahere infamiam*, it cleared the credit of Comets, and made People have good thoughts of them.

Having given ſome Account of what may be look'd for in this *Prodromus*, it follows, That ſome alſo ſhould be rendred of the *Animadverſions* mention'd to have been made upon the ſame. This was done by that *Pariſian* Philoſopher Monſieur *Auzout*, in a Letter of his to his Country-man Monſieur *Petit*; in which he ſtrongly conceives, That this

Prodromus

Prodromus contains ſome miſtakes, of which he chiefly ſingles out one, as moſt conſiderable, in *Hevelius*'s Obſervation of *Febr.* $\frac{2}{12}$, and declares thereupon, That he, and ſeveral very intelligent *Aſtronomers* of *France* and *Italy* concurring with him therein, (whereas M. *Hevelius* to him ſeems to ſtand ſingle, as to this particular) found by their Obſervations, That this Comet could not, on that day of *February*, be there where M. *Hevelius* placeth it, *viz.* in *Prima Arietis*; unleſs it be ſaid, That it viſited that Star of *Aries* on the 18th, and returned thence the 19th into its ordinary courſe; in which, according to his, and his ſeveral Correſpondents Obſervations, the Comet on *Febr.* 17. was diſtant from that *firſt Star* of *Aries* at leaſt 1 degree and 17 minutes; and on *February* 19. (he having miſſed, as well as his other Friends, the Obſervation on *Febr.* 18.) was advanced in its way 12 or 13 minutes, but yet diſtant from the ſaid Star *ſome minutes* above a *whole degree*, and conſequently far from having then paſſed it. After which time M. *Auzout* affirms to have ſeen it, as well as ſeveral others, for many days, and that until *March* $\frac{2}{12}$: obſerving, That about *Febr.* 26. or 27, when the Comet was neareſt to the often-mentioned *firſt* of *Aries*, it approached not nearer thereunto, then at the diſtance of 50 minutes.

This important Difference between two very Learned, and very deſerving Perſons, being come to the knowledge of ſome of the ableſt *Philoſophers* and *Aſtronomers* of *England*, hath been by them thought worthy their Examination: and they being at this very preſent employed in the diſcuſſion thereof, by comparing what hath been done and publiſh'd by the Diſſenters, and by confronting with them their own Domeſtick Obſervations, are very likely to diſcern where the miſtake lies; and having diſcern'd it, will certainly be found highly impartial and ingenuous in giving their ſenſe of the ſame.

Of

Of the Mundus Subterraneus *of* Athanaſius Kircher.

This long expected *Subterraneous World*, is now come to light, dedicated (at leaſt the *Exemplar*, that hath been peruſed by the *Publiſher* of theſe *Papers*, who hears, That other *Copies* bear Dedication to other *Great Princes*) both to the preſent *Pope*, as being eſteemed by the Author to have a part of his *Apoſtolical Kingdom* there; and to the *Roman Emperor* now Regnant, who indeed in his Kingdom of *Hungary*, and in ſeveral Provinces of *Germany*, hath very many and very conſiderable things, worthy to be obſerved, under *Ground*.

To give the *Curious* a taſte of the *Contents* of this *Volume*, and thereby to excite them to a farther ſearch into the receſſes of Nature, for the compoſure of a good *Natural Hiſtory*; they may firſt take notice, That the Author, having given an account in the *Preface*, what encouragement he received, for writing this Book, from the opportunity of Travelling with the *Cardinal* of *Haſſia* into *Sicily* (in which Voyage, he ſaith, He met with, as it were, an *Epitome* of what may be obſervable in the Subterraneous parts of the Earth; and in particular, with an Earth-quake of 14 days duration, very inſtructive to him concerning ſeveral great Secrets of Nature:) having, I ſay, thus Prefaced, he divideth his Work into 12 *Books*, wherein he affirms not onely to have explicated the Divine Structure of the under-ground World, and the wondrous diſtribution of the Work-houſes of Nature, and her Majeſty and Riches therein; but alſo to have opened the Cauſes of her Effects and Productions; whence, by the Marriage of Nature and Art, a happy Iſſue may follow for the uſe and benefit of Humane Life.

In the *firſt* Book, he conſiders the nature of the Centre of the Earth, where he delivers ſeveral *Paradoxes* touching the ſame, and Diſcourſes of the Motion of heavy Bodies, of Pendulems, of Projectils.

In

In the *ſecond*, he treats of the Fabrick of the *Terreſtrial Globe*, of the Influences it receives from the Cœleſtial Bodies, eſpecially the *Sun* and *Moon*, of both which *Luminaries* he gives a *Scheme*; of the proportion of the Earth to the Sun and Moon; of the external conformation of the Earth, its Mountains, and their concatenations, decreaſe and increaſe, together with the ſtrange transformation thereof. Further, of the Waters encompaſſing the Earth, and their various Communications by hidden Paſſages; as alſo of the heighth of Mountains, and of the depth of Seas; the dimenſion of the *Sicilian Straights*; the Magnetical Conſtitution of the Earth, its Heterogeneous Nature, Interior Frame, Laboratories, Caves, Channels, *&c.*

In the *third*: Of the Nature of the *Ocean*, and the diverſity of its Motions; of its general Motion from *Eaſt* to *Weſt*, Currents, Reciprocations, Gulfs, Whirle-pools, Saltneſs, *&c.*

In the *fourth*: Of the Nature of the Subterraneous *Fire*, its neceſſity, diffuſiveneſs, food, prodigious Effects through ignivomous Mountains; as alſo of the Nature of *Air* and *Winds*, their power and variety; of the general Wind, how and whence generated; of Periodical and Anniverſary Winds, and their Cauſes; as alſo of the production of Artificial Winds, for refreſhment and other advantages. To which he ſubjoyns a Diſcourſe, tending to prove, That all Meteors owe their Nativity to the Fires of the Subterraneous World.

In the *fifth*: Of the Original of Springs, Rivers, Lakes; various differences and qualities of Waters, and the marks where they are to be met with under Ground; of Waters *Medical*, hot Baths, and their Differences, Cauſes, Vertues; together with the wonderful Qualities and Properties of ſome Springs, as to their Colour, Taſte, Smell, Weight, Salubrity, Flux and reflux, Petrifying power, *&c.*

In the *ſixth*: Of the *Earth* it ſelf, and the great variety contained in the Womb thereof; of the manifold Produ-

ctions

ctions made therein, by the vertue of Salt and its Auxiliaries, the differences whereof are largely diſcourſed of, together with the way of extracting the ſame. In particular of *Saltpeter*, its Generation, Nature, Vertues; of the way of making *Gunpowder*, and the various uſes thereof; as alſo the Nature, Qualities, Preparation, Medical and other uſes of *Alume* and *Vitriol*.

In the *ſeventh*: Of ſome *Foſſils*, as Sand, Gravel, Earths, and their various Differences, Qualities, uſes Economical, Chymical, Medical: together with the ſtrange varieties and changes happening in the Earth, and their cauſes; as alſo the requiſits to *Agriculture*.

In the *eighth*: Firſt, of *Stones*, their Origine, Concretion, difference of Colours; and in particular, of *Gems* and their variety, cauſes of generation, tranſparency in ſome and colours in others; as alſo of their various Figures and Pictures, by Nature formed both in common and precious Stones, with their Cauſes. Secondly, of the Transformation of Juices, Salts, Plants, yea of Beaſts and Men turn'd into Stone: together with the generation of Bony Subſtances under Ground, by many eſteemed to be the Bones of *Gyants*; and of *Horny* Subſtances, taken for *Unicorns* horns: as alſo of *Foſſile wood* and *Coals*. Thirdly, of *Bituminous Flowers*, *lapis Aſbeſtos*, *Amber*, and its *Electrical* vertue; together with the way how Inſects, little Fiſhes, and Plants are Intombed therein. Fourthly, of Subterraneous *Animals*, Moles, Mice, Birds, Dragons; where is alſo treated, of thoſe Animals that are found in the midſt of Stones.

In the *ninth*: Firſt, of Poyſons, their primeval Origine from Minerals, and their accidental Generation in Vegetable and Animal Bodies, together with their differences; where 'tis diſcourſed, not onely how Poyſons may be bred in Men, but alſo, how the Poyſons of ſome Animals do infect and kill Men; and, where the Venom of Vipers lodges, and how mad *Dogs* and *Tarantula's* ſo communicate their Poyſon, as that it exſerts not its noxiouſneſs, till after ſome

time: Where alſo occaſion is taken to diſcourſe of the Original of Diſeaſes, and cure of Poyſonous ones. Secondly, of the wonderful Nature of *Sulphur*, *Antimony*, *Quick-ſilver*, their origine and qualities; together with the productions of *Corals* and *Pearls*.

In the *tenth*: Firſt of *Metallurgy*, and the way how that unctuous Body, out of which Mettals are produced, is elaborated by Nature, and what therein are *Sulphur*, *Salt*, and *Mercury*; beſides, what it is that renders Mettals fluid in the Fire, but not Stones and Vegetables *&c.* Secondly, of the Requiſits to a perfect knowledge of the *Metallick Art*, and of the Qualities of the *Mine*-maſter; then of the Diſeaſes of Mine-men, and their Cure, and the ways of purging the Mines of the Airs malignity; as alſo of *Metallognomy*, or the ſigns of latent Mettals, and by what Art they may be diſcovered. Thirdly, ſeveral *Accounts* ſent to the Author, upon his Inquiries by the Mine-maſters themſelves, or other chief Over-ſeers of the Mine-works, touching the variety, nature and properties of Minerals, and the many Accidents happening in Mines, particularly the *Hungarian* ones at *Schemnitz*, and thoſe of *Tyrol*. Fourthly, of ſeveral both *Hydraulick* and *Wind-Engines*, to free the Mines from Water and noxious damps. Fifthly, Of the way of working Mettals, Gold, Silver, Copper, Iron, and particularly of the method uſed at *Potoſi* in *Peru*, of extracting the Silver out of the Mineral: to which is added, a Diſcourſe of *Salt-pits*, and the way of making Salt.

In the *eleventh*, Firſt, of *Alchimy*, its Original and Antiquity, the Veſſels and Inſtruments belonging thereunto. Secondly, of the *Philoſophers Stone*, what is meant by it, and whether by means thereof true Gold can be produced? And in general, whether there be any ſuch thing, as a true and real Tranſmutation of one Metal into another? Where are delivered the ſeveral Proceſſes of the reputed *Adepti*, *Raymund Lulle*, *Azoth*, *Arnold de Villa nova*, *Paracelſus*, *Sendivogius*, &c. but all exploded as falſe and deceitful. Thirdly, of

of the decisions in Law concerning Chymical Gold, true or false. Fourthly, what the celebrated *Philosophers Stone* was among the Ancients, and what they understood by the same?

In the *twelfth*: First, Of the *seminal Principle* of all things, its origine, nature and property; of the way how Nature proceeds in the Generation of *Minerals*, *Vegetables*, *Animals*; of spontaneous Generation; of *Zeophyts*, *Insects* of all sorts, and particularly of the Worms bred in Men; together with the causes why Nature would produce such swamrs of infinite sorts of Insects. Secondly, of the variety and differences of *Vegetables*; of the requisits to know the *vertues* of *Plants*, and of the several ways of *Engrafting*. Thirdly, of the *Art of Distilling*, whereby Nature is imitated, as doing all her under-ground Works, in the Opinion of this Author, by *Distillation*. Fourthly, of the *Laboratories of various Arts*, in which, according to Natures pattern, used in her Subterraneous Operations, strange things may be performed: where treating of *Chymical Secrets*, the truth of the Preparation of *Aurum potabile* is discussed, and the *Magisteries* of Gold, Silver, Iron, Tin, Copper and Lead, examined: to which is subjoyned an *Appendix*, furnishing such Rules, whereby Students in *Chymistry* may be directed in their work, and true Operations distinguished from false ones. Fifthly, of *Metallostaticks*, whereby the mixture of Mettals and Minerals may be certainly known; together with a way of weighing the Proportions of *moist* and *dry*, existent in every Compound, as well Vegetable and Animal, as Mineral. Sixthly, of *Glass-making*, where is treated of the Nature of *Glass*; of the Artificial Production of all sorts of Precious Stones, partly from the Authors own Experiments, partly from the Communication of his Friends, and the Collection of the best Writers upon that subject. Seventhly, of *Fire-works*, where the Invention and Preparation of Gun-powder is largely discoursed of, and the ways of making *Squibs*, *Fires burning in Water*,

and many others, uſed in Publick Feſtivities, are deſcribed. Eighthly, of ſome *Mechanical Arts*, as that of *Gold-ſmiths*, *Black-ſmiths*, *Copper-ſmiths*, *Wyre-drawers*, in the laſt whereof he reſolves this *Problem*; a certain weight of Mettal, and the bigneſs of the hole, through which the Wyre is to be drawn, being given, to finde into what length ſo much Mettal can be ſpun out.

Thus you have a view of this whole *Volume*; to which it may perhaps not be amiſs to adde, for a Concluſion, ſome of thoſe Particulars which are eſteemed by the Author to out-ſhine the reſt, and are here and there inter-woven as ſuch. For example, in the *Firſt Part*.

The uſe of *Pindules*, for knowing by their means the *ſtate* of ones *Health*, from the different beatings of the *Pulſe*, *Pag.* 51.

The *Chain* of *Mountains*, ſo drawn over the Earth, that they make, as it were, an *Axis*, paſſing from *Pole* to *Pole*; and ſeveral tranſverſe *ductus*, ſo cutting that *Axis*, as to make, in a manner, an *Equator* and *Tropicks* of Mountains: by which concatenation he imagines, That the ſeveral parts of the Earth are bound together for more firmneſs, *pag.* 69.

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This may suffice, to give occasion to the Searchers of Nature, to examine this Book, and the Observations and Experiments contained therein, together with the Ratiocinations raised thereupon, and to make severer and more minute Inquiries and Discussions of all.

A farther Account of an Observation above-mentioned, about white Blood.

Since the Printing of the former Sheet, there is this farther account from the same hand. Mr. *Boyle*,

I have at length, according to your desire, receiv'd from the Ingenious Dr. *Lower*, an account in Writing of the Observation about *Chyle* found in the Blood; which though you may think strange, agrees well with some Experiments of his and mine, not now to be mention'd. The Relation, though short, comprizing the main Particulars of what he had more fully told me in Discourse, I shall give it you with little or no variation from his own Words.

A Maid,

A Maid, after eating a good Break-faſt, about ſeven in the Morning, was let Blood about eleven the ſame day in her Foot; the firſt Blood was receiv'd in a *Porringer*, and within a little while it turn'd very white; the laſt Blood was received in a *Sawcer*, which turned white immediately, like the white of a Cuſtard. Within five or ſix hours after, he (the Phyſitian) chanced to ſee both, and that in the Porringer was half Blood and half Chyle, ſwimming upon it like a Serum as white as Milk, and that in the Sawcer all Chyle, without the leaſt appearance of a drop of Blood; and when he heated them diſtinctly over a gentle Fire, they both harden'd: As the white of an Egge when 'tis heated, or juſt as the *Serum* of Blood doth with heating, but far more white. This Maid was then in good health, and onely let Blood becauſe ſhe never had her Courſes, yet of a very florid clear Complexion.

Note.

The Reader *of theſe Papers is deſired, that in thoſe of* Numb. 4. pag. 60. lin. 10. *he would pleaſe to read* eight, *inſtead of* hundred; *this latter word having been put in by a great over-ſight, and, without this Correction, injuring that Author, whoſe Conſiderations are there related. This Advertiſement ſhould have been given in* Numb. 5. *but was omitted for haſte.*

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PHILOSOPHICAL TRANSACTIONS.

Monday, *Decemb.* 4. 1665.

The Contents.

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Of Monſieur de Sons *Progreſs in working* Parabolar *Glaſſes.*

SInce what was mentioned in the immediately precedent *Tract*, touching Monſieur *de Son's* noble attempt of grinding Glaſſes of a *Parabolical* Figure, the *Publiſher* of theſe *Papers* hath himſelf ſeen two *Eye-glaſſes* of that ſhape, about one inch & a half deep, and one inch and a quarter broad, wrought by this Eminent *Artiſt* with a rare Steel-inſtrument of his own contrivance and workmanſhip, and by himſelf alſo poliſhed to admiration. And certainly it will be wondred at by thoſe,

who ſhall ſee theſe Glaſſes, how they could be truly wrought to ſuch a Figure, with ſuch a Cavity; & yet more, when they ſhall hear the Author undertake to excavate other ſuch *Eye-Glaſſes* to above two inches, and *Object-glaſſes* of five inches *Diameter*. He hath likewiſe already begun his *Object-glaſſes* for the mentioned two *Ocular* ones, of the ſame Figure of about two inches *Diameter*, which are to be left all open, yet without cauſing any colours. Of all which 'tis hoped, that ſhortly a fuller and more particular accompt will be given.

Monſieur Auzout's *Speculations of the Changes, likely to be diſcovered in the* Earth *and* Moon, *by their reſpective Inhabitants.*

This Inquiſitive *Philoſopher* in a letter of his, lately written to his correſpondent in *London*, takes occaſion to diſcourſe of his conſiderations concerning thoſe Changes, mentioned in the *Title*, as followes;

I have (ſaith he) ſometimes thought upon the *Changes*, which 'tis likely, the ſuppoſed Inhabitants of the *Moon* might diſcover in our *Earth*, to ſee, whither reciprocally I could obſerve any ſuch in the *Moon*. For example, me-thinks, that the *Earth* would to the people of the *Moon* appear to have a different face in the ſeveral ſeaſons of the year; and to have another appearance in *Winter*, when there is almoſt nothing green in a very great part of the *Earth*; when there are Countries all covered with ſnow, others, all covered with water, others, all obſcured with Clouds, and that for many weeks together: *Another* in *Spring*, when the Forreſts and Fields are green. *Another* in *Summer*, when whole Fields are yellow &c. Me thinks, I ſay, that *theſe* changes are conſiderable enough in the force of the reflexions of Light to be obſerved, ſince we ſee ſo many differences of Lights in the *Moon*. We have *Rivers* conſiderable enough to be ſeen, and they enter far enough into

into the Land, and have a bredth capable to be obſerved. There are *Fluxes* in certain places, that reach into large Countries, enough to make there ſome apparent change; & in ſome of our Seas there float ſometimes ſuch bulky maſſes of Ice, that are far greater, than the Objects, which we are aſſured, we can ſee in the *Moon*. Again, we cut down whole Forreſts, and drain Mariſhes, of an extent large enough to cauſe a notable alteration: And men have made ſuch work, as have produced Changes great enough to be perceived. In many places alſo are *Vulcans*, that ſeem big enough to be diſtinguiſht, eſpecially in the ſhadow: And when Fire lights upon Forreſts of great extent, or upon Towns, it can hardly be doubted, but theſe Luminous Objects would appear either in an Eccliſe of the Earth, or when ſuch parts of the Earth are not illuminated by the Sun. But yet, I know no man, who hath obſerved ſuch things in the *Moon*; and one may be rationally aſſured that no *Vulcans* are there, or or that none of them burn at this time. This it is (*ſo he goes on*) which all Curious men, that have good *Telescopes*, ought well to attend; and I doubt not; but, if we had a very particular *Map* of the *Moon*, as I had deſigned to make one with a *Topography*, as it were, of all the conſiderable places therein, that We or our Poſterity would find ſome changes in Her. And if the *Mapps* of the *Moon* of *Hevelius*, *Divini*, and *Riccioli*, are exact, I can ſay, that I have ſeen there ſome places conſiderable enough, where *they* put *parts that are clear*, whereas *I* there ſee *dark ones*. 'Tis true that if there be *Seas* in the *Moon*, it can hardly fall out otherwiſe, than it doth upon our *Earth*, where *Alluvium's* are made in ſome places, and the Sea gains upon the Land in others. *I ſay*, if thoſe Spots we ſee in the *Moon*, are Seas, as moſt believe them to be; whereas I have many reaſons, that make me doubt, whether they be ſo; of which I ſhall ſpeak elſewhere. And I have ſometimes thought, whether it might not be, that all the Seas of the *Moon*, if there muſt be Seas, were on the ſide of the other *Hemiſphere*, and that for this cauſe it might be that the *Moon* turns not upon its *Axis*, as our *Earth*,

wherein the Lands and Seas are, as it were, ballanced: That thence alſo may proceed the non-appearance of any Clouds raiſed there, or of any Vapors conſiderable enough to be ſeen, as there are raiſed upon this Earth; and that this abſence of Vapors is perhaps the cauſe, that no *Crepuſcle* is there, as it ſeems there is none, my ſelfe at leaſt not having hitherto been able to diſcerne any mark thereof: For, me thinks, it is not to be doubted, but that the reputed Citizens of the *Moon* might ſee our *Crepuſcle*, ſince we ſee, that the ſame is without compariſon ſtronger, than the *Light* afforded us by the *Moon*, even when ſhe is *full*; for, a little after Sun-ſet, when we receive no more the *firſt* Light of the *Sun*, the sky is far clearer, than it is in the faireſt night of the *full Moon*. Mean while, ſince we ſee in *the Moon*, when ſhe is increaſing or decreaſing, the Light, ſhe receives from the Earth, we cannot doubt, but that the People of the *Moon* ſhould likewiſe ſee in the *Earth* that Light, wherewith the *Moon* illuminates it, with perhaps the difference, there is betwixt their bigneſs. Much rather therefore ſhould they ſee the Light of the *Crepuſcle*, being, as we have ſaid, incomparably greater. In the mean time we ſee not any faint Light beyond the *Section* of the Light, which is every where almoſt equaly ſtrong, and we there diſtinguiſh nothing at all, not ſo much that cleereſt part, which is called *Ariſtarchus*, or *Porphyrites*, as I have often tryed; although one may there ſee the Light, which the *Earth* ſends thither, which is ſometimes ſo ſtrong, that in the *Moon's* decreaſe I have often *diſtinctly* ſeen *all* the parts of the *Moon*, that were *not enlightned* by the *Sun*, together with the difference of the clear parts, and the Spots, ſo far as to be able to diſcern them all. The *Shaddows* alſo of all the *Cavities* of the *Moon* ſeem to be ſtronger, than they would be, if there were a *Second* Light. For, although a far off, the ſhaddows of our Bodies, environed with Light, ſeem to Us almoſt dark; yet they doe not ſo appear ſo much, as the Shaddows of the *Moon* doe; and thoſe that are upon the *Edge* of the *Section*, ſhould

ſhould not appear in the like manner. But, I will determine nothing of any of theſe things. When I ſhall hereafter have made more frequent Obſervations of the Moon with my *great Teleſcopes*, in convenient time, I ſhall then perhaps learn more of it, than I know at preſent, at leaſt it will excite the *Curious* to endeavor to make the like Obſervations; and it may be, others, that I have not thought of.

The Inſtance of the ſame Perſon *to Mr.* Hook, *for communicating his Contrivance of making, with a Glaſs of a Sphere of* 20 *or* 40 *foot* diameter, *a* Teleſcope *drawing ſeveral hundred foot; and his offer of recompenſing that Secret with another, teaching To meaſure with a* Teleſcope *the* Diſtances of Objects *upon the Earth.*

In *Numb.* 4. Of theſe *Papers*, pag. 67. Mr. *Hook* had intimated, that he would ſhortly diſcover a way of his, with a *Plano-convex* Glaſſe of a Sphære of 20. or 40. feet *Diameter*, without *Veines*, and truly wrought of that *Figure*, to make a *Teleſcope*, that with a ſingle *Eye-glaſs* ſhould draw 300, 400, yea 1000 feet, *without* at all *altering the Convexity*: Monſieur *Auzout* returns this conſideration, and offer upon it, which follows:

To perform (*ſaith he*) with a *leſſer Object-glaſs* the effect of a *great Teleſcope*, we muſt find out a way to make ſuch an *Object-glaſs* to receive as many Rayes as one will, without their being ſenſibly diſtant from one another; to the end, that by applying to it a *ſtronger Eye-glaſs*, there may be ſtill Beams enough to ſee the Object, and to obliterate the ſmall ſpecks and imperfections of the *Eye-glaſs*. And if Mr. *Hook* hath this Invention, I eſteem it one of the greateſt, that can be found in the matter of *Teleſcopes*. If he pleaſe to impart it to us, we ſhall be obliged to him; and I wiſh,

I wiſh, I had a ſecret in *Opticks* to encourage him to that communication. If I did believe, that this would be eſteemed one, To meaſure with a *great Teleſcope* the *diſtance of Objects* upon the *Earth*; which I have found long ſince, and propoſed to ſome by way of Paradox; *Locorum diſtantias ex unica ſtatione, abſque ullo Inſtrumento Mathematico, metiri*; I doe here promiſe to diſcover it to him, with the neceſſary Tables, as ſoon as He ſhall have imparted his to me: which I will uſe, as he ſhall order me. For, although the *Practiſe* doe not altogether anſwer the *Theory* of my Invention, becauſe that the length of the *Teleſcopes* admits of ſome Latitude; yet one comes near enough, and perhaps as Juſt, as by moſt of the wayes, ordinarily uſed with Inſtruments. That, which I am propoſing, I doubt not but M. *Hook* will ſoon underſtand, and ſee the determination of all Caſes poſsible. I ſhall only ſay, that if we look upon the ſole *Theory*, we may make uſe of an ordinary *Teleſcope*, whereof the *Eye-glaſs* is to be *Convexe*: for, by putting the Glaſſes at a little greater diſtance, than they are, proportionably to the diſtance for which it is to ſerve, and by adding to it a *new Eye-glaſs*, the Object will be ſeen diſtinct, though obſcure; and if the *Eye-glaſs* be *Convexe*, the Object will appear erect. They may be done two manner of ways; either by leaving the *Teleſcope* in its ordinary ſituation, the *Object-glaſs* before the *Eye-glaſs*; or by inverting it, and putting *this* before *that*. But if any will make uſe of two *Object glaſſes*, whereof the *Focus's* are known, the diſtance of them will be known. If it be ſuppoſed, that the *Focus* of the *firſt* be B. and *that* of the *ſecond* C. and the diſtance given, B + 2 D, and that D *minus* C be *equal* to F; for this diſtance will be *equal* to $B + C + F - \frac{2}{F}C^2$. And if you have the *Focus* of the *firſt Object glaſs*, equal to B the diſtance, where you will put the *ſecond* Glaſs equal to B + C + D. the *focus* of the 2d Glaſſe will be found equal to $\frac{CD}{C+D}$. And if you will that the Object ſhall be magnified as much with theſe two Glaſſes, as it would be with a ſingle one, whereof the *Focus* ſhould

ſhould be of the diſtance given, having the *Focus* of the *Object-glaſs* given equal to B, and the diſtance given to B † D; the diſtance between the firſt and the ſecond Glaſs will be equal to $\frac{2B^2+2BD}{2B+D}$, whence ſubducting B (the *Focus* of the *Object-glaſs* given) there remains $\frac{BD}{2B+D}$; and if this ſum be ſuppoſed equal to C, we ſhall eaſily know, by the precedent Rule, the *Focus* of the *ſecond* Glaſs.

So far M. *Auzout*, who, I truſt, will receive due ſatisfaction to his deſire, as ſoon as the happy end of the preſent Contagion ſhall give a beginning and life again to the Studies and Actions of our retired *Philoſophers*.

I ſhall onely here adde, That the Secret he mentions [*of meaſuring the diſtance of Places by a Teleſcope (fitted for that purpoſe) and from one ſtation*] is a thing already known (if I am not miſ-informed) to ſome Members of our Society; who have been a good while ſince conſidering of it, and have contrived ways for the doing of it: Whether the ſame with thoſe of Mr. *Auzout*, I know not. Nor have I (at the diſtance that I am now from them) opportunity of particular Information.

An Experiment of a way of preparing a Liquor, that ſhall ſink into, and colour the whole Body of Marble, *cauſing a* Picture, *drawn on a ſurface, to appear alſo in the* inmoſt *parts of the Stone.*

This *Experiment*, having been hinted at in the next foregoing *Papers*, out of the *Mundus Subterraneus* of *Athanaſius Kircher*, and ſeveral Curious Perſons, who either have not the leiſure to read Voluminous Authors, or are not readily skilled in that Learned Tongue wherein the ſaid Book is written, being very deſirous to have it transferred hither, it was thought fit to comply with their deſire herein.

The Author therefore of the *Mundus*, &c, having ſeen ſome

ſome ſtones reputed to be *natural* that had moſt lively Pictures, not only upon them, but paſſing *thorow* their whole ſubſtance, and thereupon finding an *Artiſt*, ſkilful to perform ſuch rare workmanſhip, did not only pronounce ſuch ſtones to be *artificial*, but when that *Artiſt* was unwilling to communicate unto him his Secret, did joyn his ſtudy and endeavors with thoſe of one *Albertus Gunter* a *Saxon*, to find it out themſelves: wherein having ſucceeded, it ſeems, they made the Experiments which this Induſtrious and communicative *Jeſuit* delivers in this manner:

The Colours, ſaith he, are thus prepared; I take of *Aqua fortis* and *Aqua Regis*, two ounces *ana*; of *Sal Armoniack* one ounce; of the beſt *Spirit of Wine*, two drachms; as much *Gold* as can be had for nine *Julio's* (a *Julio* being about ſix pence Engliſh) of pure *Silver*, two drachmes. Theſe things being provided, let the Silver, when calcined, be put into a Vial; and having powred upon it the two drachmes of *Aqua fortis*, let it evaporate, and you ſhall have a Water yielding firſt a *blew* Colour, and afterwards a *black*. Likewiſe put the Gold, when calcin'd, into a Vial, and having powred the *Aqua Regis* upon it, ſet it by to evaporate: then put the *Spirit of Wine* upon the *Sal Armoniack*, leaving it alſo till it be evaporated; and you will have a Golden coloured Water, which will afford you divers Colours. And, after this manner, you may extract many *Tinctures* of Colours out of other Mettals. This done, you may, by the means of theſe two Waters, paint what Picture you pleaſe upon white Marble, of the *ſofter* kind, renewing the Figure every day for ſeveral days with ſome freſh ſuperadded Liquor, and you ſhall find in time, that the Picture hath penetrated the *whole* ſolidity of the Stone, ſo that cutting it into as many parts as you will, it will always repreſent unto you the ſame Figure on both ſides.

So far he, which how far it anſwers expectation, is referred to the Tryal of Ingenious Artiſts. In the mean time there are not wanting Experienced Men that ſcruple the Effect, but they

yet are far from pronouncing any thing positively against it, so that they doe not discourage any that have conveniencies, from trying.

But whether the way there mentioned will succeed, or not, according to expectation: Sure it is that a Stone-cutter in *Oxford*, Mr. *Bird*, hath many years since found out a way of doing the same thing, in effect, that is here mentioned; and hath practised it for many years. That is, he is able so to apply a colour to the outside of polished Marble, as that it shall sink a considerable depth into the body of the stone; and there represent like figures or images as those are on the out side; (deeper or shallower according as he continues the application, a longer, or lesser while.) Of which kind there be divers pieces to be seen in *Oxford*, *London*, and elsewhere. And some of them being shewed to his Majesty, soon after his happy restauration, they were broken in his presence, and found to answer expectation. And others may be dayly seen, by any who is curious, or desirous to see it.

An Intimation of a Way, found in Europe *to make* China-dishes.

Notice was lately given by an inquisitive *Parisian* to a friend of his in *London*, that by an Acquaintance he had been informed, that Signor *Septalio*, a Canon in *Millan*, had the Secret of making as good *Porcelane* as is made in *China* it self, and transparent; adding that he had seen him make some.

This as it deserves, so it will be further inquired after, if God permit.

An Account of an odd Spring *in* Westphalia, *together with an Information touching* Salt-Springs *and the straining of salt-water.*

An observing Gentleman did lately write out of *Germany*, that in *Westphalia* in the Diocess of *Paderborn*, is a Spring, which looses it self twice in 24 houres; coming always, after 6 houres, back again with a great noise and so forcibly, as

to drive 3 Mills not far from its source. The Inhabitant call it the *Bolderborn*, as if you should say, the *Boysterous Spring*.

The same Person, having mentioned the many *Salt-Springs* in *Germany*, as those at *Lunenburg*, at *Hall* in *Saxony*, at *Saltzwedel* in *Brandenburger Mark*, in *Tyrol*, &c. observes, that no Salt-water, which contains any Metal with it, can well be sodden to Salt in a Vessel of the same Metal, which it self contains, except *Vitriol* in Copper Vessels.

He adds, that, to separate Salt from Salt-water, without Fire, if you take a Vessel of Wax, hollow within, and every where tight; and plunge it into the Sea, or into other Salt-water, there will be made such a separation, that the vessel shall be full of sweet water, the Salt staying behind: but, though this water have no saltish taste, yet, *he saith*, there will be found a Salt in the Essay, which is the Spirit of Salt, subtile enough with the water to penetrate the Wax.

An Account of the Rise and Attempts, of a Way to conveigh Liquors immediately into the Mass of Blood.

Whereas there have lately appeared in publick some *Books*, printed beyond the Seas, treating of the Way of *Injecting liquors into Veines*; in which Books the *Original* of that *Invention* seems to be adscribed to others, besides him, to whom it really belongs; It will surely not be thought amiss, if something be said, whereby the true *Inventor's* right may beyond exception be asserted & preserved; To which end, there will need no more, than barely to represent the *Time* when, and the *Place* where, & among whom it was first started and put to tryal. To joyn all these circumstances together, 'Tis notorious, that at least six years since (a good while before it was heard off, that any one did pretend to have so much as thought of it) the Learned and Ingenious Dr. *Christopher Wren* did propose in the *University* of *Oxford* (where he now is the Worthy Savilian Professor of *Astronomy*, and where very many Curious Persons are ready to attest

teſt this relation) to that Noble Benefactor to Experimental Philoſophy, Mr. *Robert Boyle*, Dr. *Wilkins*, and other deſerving Perſons, That he thought, he could eaſily contrive a Way to conveigh any liquid thing immediately into the Maſs of Blood; *videl*: By making Ligatures on the Veines, and then opening them on the ſide of the Ligature towards the Heart, and by putting into them ſlender Syringes or Quills, faſtened to Bladders (in the manner of Clyſter-pipes) containing the matter to be injected; performing that Operation upon pretty big and lean doggs, that the Veſſels might be large enough and eaſily acceſſible.

This Propoſition being made, M. *Boyle* ſoon gave order for an *Apparatus*, to put it to Experiment; wherin at ſeveral times, upon ſeveral Doggs, *Opium* & the Infuſion of *Crocus Metallorum* were injected into that part of the hind-legs of thoſe Animals, whence the larger Veſſels, that carry the Blood, are moſt eaſy to be taken hold of: whereof the ſucceſs was, that the *Opium*, being ſoon circulated into the Brain, did within a ſhort time ſtupify, though not kill the Dog; but a large Doſe of the *Crocus Metallorum*, made an other Dog vomit up Life and all: All which is more amply and circumſtantially delivered by Mr. *Boyle* in his Excellent Book of the *Uſefulneſs of Experimental Philoſophy*, Part. 2. Eſſay 2. pag. 53. 54. 55. Where 'tis alſo mention'd, that the fame of this Invention and of the ſucceeding Tryals being ſpread, and particularly coming to the knowledge of a foreign *Ambaſſadour*, that was Curious, and then reſided in *London*, it was by him tryed with ſome *Crocus Metallorum*, upon a Malefactor, that was an inferiour Servant of his; with this ſucceſs, that the Fellow, as ſoon as ever the Injection began to be made, did, either really or craftily, fall into a ſwoon; whereby, being unwilling to proſecute ſo hazardous an Experiment, they deſiſted, without ſeeing any other effect of it, ſave that it was told the Ambaſſadour, that it wrought once downwards with him. Since which time, it hath been frequently practiſed both in *Oxford* & *London*; as well before the *Royal Society*, as elſewhere. And particularly that Learned

Physitian, Dr. *Timothy Clerk*, hath made it part of his busi-nes, to pursue those Experiments with much industry, great accurateness, and considerable observations thereon; which above two years since, were by him produced and read be-fore the *Royal Society*, who thereupon desired him, as one of their Members, to compleat, what he had proposed to him-self upon that subject, and then to publish the same: the Effect whereof 'tis hoped, will now shortly appear, and not prove unwelcome to the Curious.

Some whereof, though they may conceive, that liquors thus injected into Veines without preparation and digestion, will make odde, commotions in the Blood, disturb Nature, and cause strange Symptoms in the Body, yet they have other thoughts of Liquors, that are prepared of such things, as have passed the Digestion of the Stomach; for example, of Spirit of Urine, of Harts-horne, of Blood &c. And they hope likewise, that besides the *Medical* Uses, that may be made of this *Invention*, it may also serve for *Anatomical* purposes, by filling, after this way, the vessels of an Ani-mal as full, as they can hold, and by exceedingly distending them, discover *New* Vessels, &c: But not now to enlarge upon the Uses, the Reader may securely take this Narrative, as the naked real Matter of Fact, whereby 'tis as clear, as Noon-day (both from the Time, and irrefragable Testimo-ny of very many considerable Persons in that University, who can jointly attest it; as well as from that particular unque-stionable one of Mr. *Boyle* and his worthy Company, who were the first Eye-witnesses of the Tryals made,) that to *Ox-ford*, and in it, to Dr. *Christopher Wren*, this Invention is due; and consequently, that all others, who discourse or write of it, doe either derive it from Him, or are fallen upon the same Devise several years after Him.

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PHILOSOPHICAL TRANSACTIONS.

Munday, *Januar.* 8. 166$\frac{1}{6}$.

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An Account of the Tryalls, made in Italy *of* Campani's *new* Optick Glaſſes.

AN Inquiſitive *Pariſian* writes to his Correſpondent in *London*, as follows;

We received lately news from *Rome*, from a very Curious Perſon of our acquaintance, importing, that *Campani* hath had the advantage of *Divini*. The Great Duke of *Toskany*, and Prince *Leopold*, his Brother, upon Tryal, made of both their Glaſſes, have found thoſe of *Campani* excel the other, and with them they have been able, eaſily to diſtinguiſh people

at 4 Leagues diſtance: Of which I intend you more particulars hereafter.

Among them are expected the *Length* of theſe *Teleſcopes*, and the Largeneſs of the *Aperture* of their *Object-glaſſes*. In the mean time, the *Parabolical-glaſſes*, formerly mentioned to be in hand here at *London*, are finiſhing with all poſſible care and induſtry.

A Further Relation of the Whale-fiſhing *about the* Bermudas, *and on the Coaſt of* New-England *and* New-Netherland.

The ſame Perſon, that communicated the particulars about the new Whale-fiſhing near the *Bermudas*, mentioned in the firſt of theſe *Tracts*, gives this further Information; That there have been ſince taken by order of the *Bermudas* Company, ſixteen of thoſe Whales, the Oyle whereof, to the quantity of 50 or 60 Tuns arrived in *Ireland* at *Limrick*, ſome few months agoe.

He adds, that about two years ſince, there ſtranded upon the Coaſt of *New-England* a dead Whale, of that ſort, which they call *Trumpo*, having Teeth reſembling thoſe of a Mill, and its mouth at a good diſtance from, and under the Noſe or Trunk, and ſeveral boxes or partitions in the Noſe, like thoſe of the Tailes in Lobſters; and that that being open'd there run out of it a thin oily ſubſtance, which would candy in time; after which, the remainder, being a thick fatty ſubſtance, was taken out of the ſame part, with a ſcoope. And this ſubſtance he affirmed to be the *Sperma Ceti*; adding further, that the *Blubber*, as they call it, it ſelf, of the ſame ſort of Whales, when ſtewed, yields on the top a creamy ſubſtance, which taken off, and thrown upon white lime, lets fall a dirty heterogeneous ſediment, but what remains aloft, affords a *Sperma-Ceti*-like matter.

He

He concluded his relation with obſerving, that theſe whales were to be met with, between the Coaſt of *New-England*, and *New-Netherland*, where they might be caught eight or nine months in the year, whereas thoſe about the *Bermudas* are to be found there only in the Months of *February*, *March* and *April*.

Concerning the death of the Whale, which hath been related to have ſtranded upon *New-England*, it is not very improbable, but, (that Fiſh having alſo more than one Enemy, whereof a ſmall Fiſh called the *Treſher*, is one, who, by Mr. *Terry's* Relation in his *Eaſt-Indian* Voyage, with his nimbleneſs vexes him as much, as a Bee does a great Beaſt on the land; and a certain horny Fiſh another, who runs its horn into the Whal's belly) it may have been kill'd by the latter of theſe two; which kind of Fiſh is known, ſometimes to run its horn into Ships (perhaps taking them for Whales) and there ſnapping it aſunder; as hapned not long ſince to an Engliſh Veſſel in the *Weſt-Indian* Seas; the broken piece of that Horn being by the Maſter of that ſhip preſented to the King, and now kept in His Majeſties Repoſitory: the like wherof befel a *French* Veſſel, ſailing towards the *Eaſt-Indies*, according to the Relation, made by Monſieur *Thevenot* in his ſecond *Tome* of *Curious Voyages*.

Of a remarkable Spring, about Paderborn *in* Germany.

An inquiring Gentleman of thoſe parts writes to his Friend in *London*, as follows;

In this Dioceſs of *Paderborn*, about 2 leagues from that Town, is a treble Spring call'd *Metborn*, which has three ſtreams, two wherof are not above one foot and and a half diſtant from one another, and yet of ſo differing qualities, that whereas one of them is limpid, blewiſh, lukewarm, bubling, and holding Sal-armoniack, Ochra, Iron, Vitriol, Allum,

Allum, Sulphur, Niter, Orpiment, uſed againſt Epilepſies bad Spleens, and the Wormes; the other is Ice-cold, turbid and whitiſh, much ſtronger in taſt, and heavier than the former, holding much Orpiment, Salt, Iron, Niter, and ſome Sal-Armoniack, Allum and Vitriol; Of this all Birds, obſerved to drink of it, doe dye; which I have alſo privately experimented by taking ſome of it home, and giving it to Hens, after I had given them Oates, Barly and Bread-crums: For, ſoon after they had drunk of it, they became giddy reeled, and tumbled upon their backs, with convulſion-fitts, and ſo dyed with a great extention of their leggs. Giving them common-ſalt immediatly after they had drunk, they dyed not ſo ſoon; giving them vineger, they dyed not at all, but ſeven or eight days after were troubled with the *Pipp*. Thoſe that dyed, being open'd, their Lungs were found quite ſhrivelled together. Yet ſome men, that are troubled with Worms, taking a litle quantity of it, and diluting it in common water, have been obſerved by this means to kill the Worms in their bellies, ſo that a great number of worms come from them; whereupon though they are ſick, yet they dye not. As to the third ſtream, that lyes lower than the other two, about 20 paces diſtant from them, it is of a greeniſh colour, very clear, and of a ſowre ſweet taſt, pleaſing enough. It hath about a middle weight between the other two; whence wee gueſs, that it is mixed of them both, meeting there together: to confirm which, we have mixed equal quantities, of thoſe two, with an addition of a litle common well-water, and have found that they, being ſtirred together and permitted to ſetle, made juſt a water of the ſame colour and taſt of this third ſtream.

Of ſome other not-common Springs at Baſel *and in* Alſatia.

A Curious Perſon writes from thoſe Places in manner following; At

At *Baſel* the Spring, running in the *Gerbergaſſe* (or *Tanners-ſtreet*) from St. *Leonard's* Hill, is of a Blewiſh colour, and ſomewhat troubled, holding Copper, Bitumen, and Antimony, about 3 parts of the firſt, one of the ſecond, and two of the laſt, as has been examined by skilful Perſons. Our Tanners do water their Skins in it; and being a well-taſted and wholſome Water, it is both much drunk, and uſed to Bath in. It mingles with another Spring water, call'd the *Birſick*, and with it, between the *Salt-tower* and the *Rhine-gate* runs into the *Rhine*.

In the ſame Town (which abounds with Spring-waters) there are two, among the reſt, called *Bandulph's-well*, and *Brun Zum Brunnen*, that are more obſervable then the other; the former of them having a *Camphory* and drying Quality, and uſed againſt Hydropical Diſtempers; the latter containing ſome Sulphur, Saltpeter and Gold, and being an excellent Water to drink, much uſed in the principal Tavern of the City, where the chief of the Town do reſort, and near which it runs.

In *Alſatia* in the Valley, called *Leberthal*, near *Geesbach* (an ancient Mine-work) there runs out a of *Cavern* a foul, fattiſh, oily Liquor, which, though the Country-men of that place employ to the vile uſe of greaſing their Wheels, inſtead of ordinary Wheel-greaſe; yet doth it afford an excellent Balſom, by taking a quantity of it, and putting it in an Earthen Pot well luted, that no ſteam may exhale; and then with a gentle Fire at firſt, but a ſtronger afterwards, boyling it for three hours together; in which ſpace it will boyl in a fourth part, and an Earthen Matter, like Pitch, will ſettle it ſelf at the bottom: but on the top thereof, when cold, there will ſwim a fatty Subſtance, like Lyne-Oyl, limped and ſomewhat yellowiſh, which is to be decanted from the thick Sediment, and then gently diſtilled in an Alembick in *Arena*; by which means, there will come over two differing Liquors, one Phlegmatick, the other Oily, which

which latter ſwimming on the Phlegm, is to be ſevered from it. The Phlegm is uſed as an excellent Reſiſter and Curer of all the Putrefactions of the Lungs and Liver, and it heals all foul Wounds and Ulcers. The Oily part, being diluted with double its quantity of diſtilled Vineger, and brought three times over the Helm, yields a rare Balſom, againſt all inward and outward Corruptions, ſtinking Ulcers, hereditary Scurfs and Scabs: 'Tis alſo much uſed againſt Apoplexies, Palſies, Conſumptions, Giddineſſes, and Head-aches. Inwardly they take it with Succory-water againſt all corruptions of the Lungs. It is a kind of *Petroleum*, and contains no other Mineral Juice, but that of *Sulphur*, which ſeems to be thus diſtilled by *Nature* under ground; the diſtillation of an Oyl out of *Sulphur* by Art, being not ſo eaſie to perform.

Of the richeſt Salt-Springs *in* Germany.

An Account having been deſired of thoſe two chief *Salt-Springs* in *Germany*, at *Hall* and *Lunenburg*, it was lately tranſmitted thus:

The *Salt-Springs* at *Hall* in *Saxony* are four, called *Gutiaar*, the *Dutch-Spring*, the *Mettritz*, and the *Hackel-dorn*; whereof the three firſt hold near the ſame proportion of Salt; the laſt holds leſs, but yields the pureſt Salt. The three firſt hold about ſeven parts of Salt, three of Marcaſit, and fourteen of Water: They are, beſides their Oeconomical uſe, employed Medicinally to Bath in, and to draw a Spirit out of it, exhibited with good ſucceſs againſt Venom, and the putrefaction of the Lungs, Liver, Reins, and the Spleen.

The *Salt-Water* at *Lunenburgh*, being more greeniſh then white, and not very tranſparent, is about the ſame nature and hold with that of *Hall*. It hath a mixture of Lead with it, whence alſo it will not be ſod in Leaden Pans; and if it held no Lead at all, it would not be ſo good, that Mettal being judged to putrefie the Water: whence alſo the Salt of *Lunenburgh*

nenburg is preferred before all others, that are made of Salt-Springs.

Some Obſervations of ſwarms of ſtrange Inſects, and the Miſchiefs done by them.

A great Obſerver, who hath lived long in *New England*, did upon occaſion, relate to a Friend of his in *London*, where he lately was, That ſome few Years ſince there was ſuch a ſwarm of a certain ſort of Inſects in that *Engliſh* Colony, that for the ſpace of 200 Miles they poyſon'd and deſtroyed all the Trees of that Country; there being found innumerable little holes in the ground, out of which thoſe Inſects broke forth in the form of *Maggots*, which turned into *Flyes* that had a kind of taile or ſting, which they ſtruck into the Tree, and thereby envenomed and killed it.

The like Plague is ſaid to happen frequently in the Country of the *Coſacks* or *Ukrani*, where in dry Summers they are infeſted with ſuch ſwarms of *Locuſts*, driven thither by an *Eaſt*, or *South-Eaſt* Wind, that they darken the Air in the faireſt weather, and devour all the Corn of that Country; laying their Eggs in *Autumn*, and then dying; but the Eggs, of which every one layeth two or three hundred, hatching the next Spring, produce again ſuch a number of Locuſts, that then they do far more miſchief than afore, unleſs Rains do fall, which kill both Eggs and the Inſects themſelves, or unleſs a ſtrong *North* or *North-Weſt* Wind ariſe, which drives them into the *Euxine* Sea: The Hogs of that Country loving theſe Eggs, devour alſo great quantities of them, and thereby help to purge the Land of them; which is often ſo moleſted by this Vermine, that they enter into their Houſes and Beds, fall upon their Tables and into their Meat, inſomuch that they can hardly eat without taking down ſome of them; in the Night when they repoſe themſelves upon the ground, they cover it three or four Inches thick, and if a Wheel paſs

over

over them, they emit a ſtench hardly to be endured: All which, and much more may be fully ſeen in the *French* Deſcription of the Countries of *Poland*, made by *Monſieur de Beauplan*, and by *Monſieur Thevenot*, in his Relation of the *Coſacks*, contained in the Firſt part of his *Curious Voyages*.

An Obſervation touching the Bodies of Snakes and Vipers.

Several have taken notice, that there is a difference between the brooding of Snakes and Vipers, thoſe laying their Eggs in Dung-hills, by whoſe warmth they are hatched; but theſe (Vipers) brooding their Eggs within their Bellies, and bringing forth live Vipers. To which may be added, That ſome affirm to have ſeen Snakes lye upon their Eggs, as Hens ſit upon theirs.

Some Obſervations of odde Conſtitutions of Bodies.

A very curious Perſon, ſtudying Phyſick at *Leyden*, to whom had been imparted thoſe Relations about a Milky Subſtance in Veins, heretofore alledged in *Numb.* 6. returns, by way of gratitude, the following Obſervations.

There was (ſaith he) not many Years ſince, in this Country a Student, who being much addicted to the ſtudy of *Aſtronomy*, and ſpending very many Nights in Star-gazing, had, by the Nocturnal wet and cold temper of the Air, in ſuch a manner obſtructed the pores of his skin, that little or nothing exhaled from his Body; which appeared hence, becauſe that the ſhirt, he had worn five or ſix weeks, was then as white as if he had worn it but one day. In the mean while he gathered a ſubcutaneous Water, of which yet he was afterwards well cured.

We have alſo (*ſaith the ſame*) ſeen here a young Maid, of about thirteen Years of age, which from the time that ſhe was but ſix Years old, and began to be about her Mother in the

the Kitchin, would, as often as ſhe was bid to bring her Salt, or could elſe come at it, fill her Pockets therewith, and eat it, as other children doe Sugar: whence ſhe was ſo dried up, and grown ſo ſtiff, that ſhe could not ſtirre her limbs, and was thereby ſtarved to death.

That Learned and Obſerving Doctor *John Beal*, upon the peruſal of the forementioned *Numb*, 6. was pleaſed to communicate this Note

To your Obſervation, of Milk in Veines, I can add a *Phænomenon* of ſome reſemblance to it, which I received above 20. years agoe from *Thomas Day*, an Apothecary in *Cambridg*; *vid.* That himſelf let a man bloud in the arme, by order of Doctor *Eade*, a Phyſitian there. The mans bloud was white as Milk, as it run out of his arme, it had a little dilute redneſs, but immediately, as it fell into the Veſſel, it was preſently white; and it continued like drops of Milk on the pavement, where ever it fell. The conjecture which the ſaid Phyſitian had of the cauſe of this appearance, was, that the Patient had much fed on Fiſh; affirming withall, that he had ſoon been a Leper, if not prevented by Phyſick.

A way of preſerving Ice and Snow by Chaffe.

The Ingenious Mr. *William Ball* did communicate the relation hereof, as he had received it from his Brother, now reſiding at *Livorne*, as follows;

The Snow, or Ice-houſes are here commonly built on the ſide of a ſteep hill, being only a deep hole in the ground, by which meanes, they eaſily make a paſſage out from the bottom of it, to carry away all the water, which, if it ſhould remain ſtagnating therein, would melt the Ice and Snow: but they thatch it wich ſtraw, in the ſhape of a Saucepan-cover, that the rain may not come at it. The ſides (ſuppoſing it dry) they line not with any thing, as is done in St *Jeames*'s Park, by reaſon of the moiſtneſs of the ground. This Pit they fill

full of Snow or Ice (taking care that the Ice be made of the pureſt water, becauſe they put it into their wine) over-ſpreading firſt the bottom very well with *Chaffe* ; by which I mean not any part of the ſtraw, but what remains upon the winnowing of the Corn; and I think, they here uſe Barley-chaffe. This done, they further, as they put in the Ice, or the Snow, (which latter they ram down,) line it thick by the ſides with ſuch Chaffe, and afterwards cover it well with the ſame; and in half a years lying ſo, 'tis found not to want above an eight part of what it weighed, when firſt put in. When ever they take it out into the Aire, they wrap it in this Chaffe, and it keeps to admiration. The uſe of it in *England* would not be ſo much for cooling of drinks, as 'tis here generally uſed ; but for cooling of fruit, ſweet-meats &c. *So far this Author.*

The other uſual way both in *Italy* and other Countries, to conſerve Snow and Ice with *Straw* or *Reed*, is ſet down ſo punctually by Mr. *Boyle* in his *Experimental Hiſtory of Cold*, pag. 408. 409. that nothing is to be added. It ſeems *Pliny* could not paſs by theſe *Conſervatories*, and the cooling of drinks with Ice, without paſſing this ſevere, though elegant and witty, Animadverſion upon them: *Hi Nives, illi glaciem potant, pœnáſque montium in voluptatem gulæ vertunt : Servatur algor æſtibus , excogitatúrque ut alienis menſibus nix algeat*, lib. 19. cap. 4. But the *Epigrammatiſt* ſports with it thus;

Non potare nivem, ſed aquam potare rigentem
De nive, commenta eſt ingenioſa ſitis. Martial. 14. *Ep.* 117.

Directions for Sea-men, bound for far Voyages.

It being the Deſign of the *R. Society*, for the better attaining the End of their Inſtitution , to ſtudy *Nature* rather than *Books*, and from the Obſervations, made of the *Phænomena* and Effects ſhe preſents, to compoſe ſuch a Hiſtory

ry of Her, as may hereafter ſerve to build a Solid and Uſeful Philoſophy upon; They have from time to time given order to ſeveral of their Members to draw up both *Inquiries* of things Obſervable in forrain Countries, and *Directions* for the Particulars, they deſire chiefly to be informed about. And conſidering with themſelves, how much they may increaſe their *Philoſophical* ſtock by the advantage, which *England* injoyes of making Voyages into all parts of the World, they formerly appointed that Eminent Mathematician and Philoſopher Maſter *Rooke*, one of their Fellowes, and *Geometry* Profeſſor of *Greſham Colledge* (now deceaſed to the great detriment of the Common-wealth of Learning) to think upon and ſet down ſome *Directions* for *Sea-men* going into the *Eaſt* & *Weſt-Indies*, the better to capacitate them for making ſuch obſervations abroad, as may be pertinent and ſuitable for their purpoſe; of which the ſaid Sea-men ſhould be deſired to keep an exact *Diary*, delivering at their return a fair Copy thereof to the *Lord High Admiral* of *England*, his Royal Highneſs the *Duke* of *York*, and another to *Trinity-houſe* to be peruſed by the *R. Society*. Which *Catalogue* of *Directions* having been drawn up accordingly by the ſaid Mr. *Rook*, and by him preſented to thoſe, who appointed him to expedite ſuch an one, it was thought not to be unſeaſonable at this time to make it publique, the more conveniently to furniſh Navigators with Copies thereof. They are ſuch, as follow;

1. To obſerve the Declination of the *Compaſs*, or its Variation from the *Meridian* of the place, frequently; marking withal, the *Latitude* and *Longitude* of the place, wherever ſuch Obſervation is made, as exactly as may be, and ſetting down the *Method*, by which they made them.

2. To carry *Dipping Needles* with them, and obſerve the Inclination of the Needle in like manner.

3. To remark carefully the Ebbings and Flowings of the Sea, in as many places as they can, together with all the Ac-

dents, Ordinary and Extraordinary, of the Tides; as, their preciſe time of Ebbing and Flowing in Rivers, at *Promontories* or *Capes*; which way their Current runs, what Perpendicular diſtance there is between the higheſt Tide and loweſt Ebb, during the Spring-Tides and Neap-Tides; what day of the *Moons* age, and what times of the year, the higheſt and loweſt Tides fall out: And all other conſiderable Accidents, they can obſerve in the Tides, cheifly neer Ports, and about Ilands, as in St. *Helena*'s Iland, and the three Rivers there, at the *Bermodas* &c.

4. To make Plotts and Draughts of proſpect of Coaſts, Promontories, Iſlands and Ports, marking the Bearings and Diſtances, as neer as they can.

5. To ſound and marke the Depths of Coaſts and Ports, and ſuch other places nere the ſhoar, as they ſhall think fit.

6. To take notice of the Nature of the Ground at the bottom of the Sea, in all Soundings, whether it be Clay, Sand, Rock, *&c.*

7. To keep a Regiſter of all changes of Wind and Weather at all houres, by night and by day, ſhewing the point the Wind blows from, whether ſtrong or weak: The Rains, Hail, Snow and the like, the preciſe times of their beginnings and continuance, eſpecially *Hurricans* and *Spouts*; but above all to take exact care to obſerve the *Trade-Wines*, about what degrees of *Latitude* and *Longitude* they firſt begin, *where* and *when* they ceaſe, or change, or grow ſtronger or weaker, and how much; as near and exact as may be.

8. To obſerve and record all Extraordinary *Meteors*, Lightnings, Thunders, *Ignes fatui*, Comets, *&c.* marking ſtill the places and times of their appearing, continuance, &c.

9. To carry with them good Scales, and Glaſſe-Violls of a pint or ſo, with very narrow mouths, which are to be fill'd with Sea-water in different degrees of *Latitude*, as often as they

they pleaſe, and the weight of the Vial full of water taken exactly at every time, and recorded, marking withall the degree of *Latitude*, and the day of the Month: And that as well of water near the Top; as at a greater Depth.

Some Obſervations concerning Jupiter. *Of the ſhadow of one of his* Satellites *ſeen, by a Teleſcope paſſing over the Body of* Jupiter.

I have received an Account from very good hands, That on the 26th. of *September* laſt, at half hour after ſeven of the Clock, was ſeen, both in *Holland* and in *France* (by curious Obſervers, with very good Teleſcopes) the ſhadow of one of the *Satellites* of *Jupiter*, paſſing over his Body. One of thoſe ſmall Stars moving about his Body (which are therefore called his *Satellites*) coming between the Sun and it, made a ſmall Eclipſe, appearing in the Face of *Jupiter* as a little round black Spot. The Particulars of thoſe Obſervations, when they ſhall come to our Hands, we may (if need be) make them publik: Which Obſervations, as they are in themſelves very remarkable, and argue the Excellency of the Glaſſes by which they were diſcovered; So are we, in part, beholding to Monſieur *Caſſini* for them, who giving notice before-hand of ſuch Appearances to be expected, gave occaſion to thoſe Curious Obſervers to look for them.

Of a permanent Spot in Jupiter: *by which is manifeſted the converſion of* Jupiter *about his own Axis.*

Beſides that Tranſient Shadow laſt mentioned, there hath been obſerved, by Mr. *Hook* firſt (as is mentioned in *Numb.* 1. of theſe *Tranſact.*) and ſince by M. *Caſſini*, a permanent Spot in the Diſque of *Jupiter*; by the help whereof, they have been able to obſerve, not onely that *Jupiter* turns about upon his own Axis, but alſo the Time of ſuch converſion; which he eſtimates

eſtimates to be, 9 hours and 56 minutes.

For as *Kepler* did before conjecture, from the motion of the Primitive Planets about the Sun as their Center, that the Sun moved about its own Axis, but could not prove it, till by *Galileo* and *Shiner* the Spots in the Sun were diſcovered; ſo it hath been thought reaſonable, from the Secundary Planets moving about *Jupiter*, that *Jupiter* is alſo moved about his Axis; yet, till now, it hath not been evinced by Obſervation, That it doth ſo move; much leſs, in what Period of Time. And the like reaſon there is to judge ſo of *Saturn*, becauſe of the Secundary Planet diſcovered by Monſieur *Hugens de Zulichem* to move about it; (though ſuch motion be not yet evinced from Obſervation:) as well as that of the *Earth*, from its Attendant the *Moon*.

Whether the ſame may be alſo concluded of the other Planets, *Mars*, *Venus*, and *Mercury*, (about whom have not yet been obſerved any Secondary Planets to move,) is not ſo evident. Yet there may be ſomewhat of like probability in thoſe. Not onely, becauſe it is poſſible they may have Secundary Planets about them, though not yet diſcovered; (For, we know, it was long after thoſe of *Jupiter*, before that about *Saturn* was diſcovered; and who knows, what after times may diſcover about the reſt?) But becauſe the Primary Planets being all in like manner inlightned by the Sun, and (in all likely hood) moved by it; it is likely that they be moved by the ſame Laws aud Methods; and therefore, turn'd about their own Axis, as it is manifeſt that ſome of them are.

But, as for the Secundary Planets, as well thoſe about *Jupiter*, as that about *Saturn*; it is moſt likely that they have no ſuch Rotation upon their Axis. Not ſo much, becauſe, by reaſon of their ſmalneſs, no ſuch thing hath been yet obſerved, (or, indeed, could be, though it were true;) But becauſe they being Analogical to our *Moon*, it is moſt likely that they are moved in like manner. Now, though it be true,

true, that there is ſome kind of *Libration* of the Moon's body, ſo that we have not preciſely juſt the ſame part of it looking towards us; (as is evident by *Hevelius* obſervations, and others;) yet is there no Revolution upon its Axis; the ſame part of it, with very little alteration, always reſpecting us, as is to be ſeen in *Hevelius* his Treatiſe *de Motu Lunæ Libratorio*; and, indeed, by all thoſe who have written particularly of the ſpots in the Moon; and is univerſally known to all that have with any curioſity viewed it with Teleſcopes.

Of ſome Philoſophical and curious Books, that are ſhortly to come abroad.

1. Of the *Origine* of *Forms* and *Qualities*, deduced from *Mechanical* Principles; by the Honorable *Robert Boyle* Eſq.

2. *Hydroſtatical Paradoxes*, by the ſame. Both in *Engliſh*.

3. A Tract of the *Origine* of the *Nile*, by Monſieur *Iſaac Voſſius*, oppoſed to that of Monſieur *de la Chambre*, who is maintaining, That *Niter* is the principal cauſe of the Inundation of that River.

4. A Diſſertation of *Vipers*, by *Signor Redi*, an *Italian*.

5. A Diſcourſe of the *Anatomy* of *a Lyon*, by the ſame.

6. Another, *De Figuris Salium*, by the ſame.

7. A Narration of the Eſtabliſhment of the *Lyncei*, an *Italian* Academy, and of their Deſign and Statutes: the Prince *Ceſi* being the Head of them, who did alſo intend to eſtabliſh ſuch Philoſophical Societies in all parts of the World, and particularly in *Africa* and *America*, to be by that means well informed of what conſiderable productions of Nature were to be found in thoſe parts. The Author yet *Anonymus*.

8. To theſe I ſhall add, a Book newly Printed in *Oxford* (and not yet diſperſed) being, *A Catalogue of Fixed Stars* with their *Longitudes*, *Latitudes*, *and Magnitudes*, according to the *Obſervations* of *Ulegbeig* (a King, and famous Aſtronomer, who was *Great-Grand-childe* to the famous *Tamerlane*

lane, and one of his Succeſſors in ſome of his Kingdoms) made at *Samarcand*, his cheief ſeat, (for the year of the Hegira 841, for the year of Chriſt 1437.) who not finding the *Tables* of *Ptolemy* to agree ſufficiently with the Heavens, did with great diligence, and expenſe, make obſervations anew; as *Tycho Brahe* hath ſince done. It is a ſmall part of a larger *Aſtronomical Treatiſe* of his, whereof there be divers *Perſian* Manuſcript Copies in *Oxford*. Out of which this is Tranſlated and Publiſhed, both in *Perſian* and *Latine* by Mr. *Thomas Hyde*, now Library Keeper to the *Bodleyan* Library in *Oxford*: (with Commentaries of his annexed:) Like as another part of it hath formerly been by Mr. *John Graves*. And it were a deſirable work that the whole were Tranſlated, that we might be the better acquainted with what was the Eaſtern Aſtronomy at that time.

Publiſhed with Licenſe.

Oxford, Printed by *A:* & *L: Lichfield*,
for *Ric: Davis*. 1666.

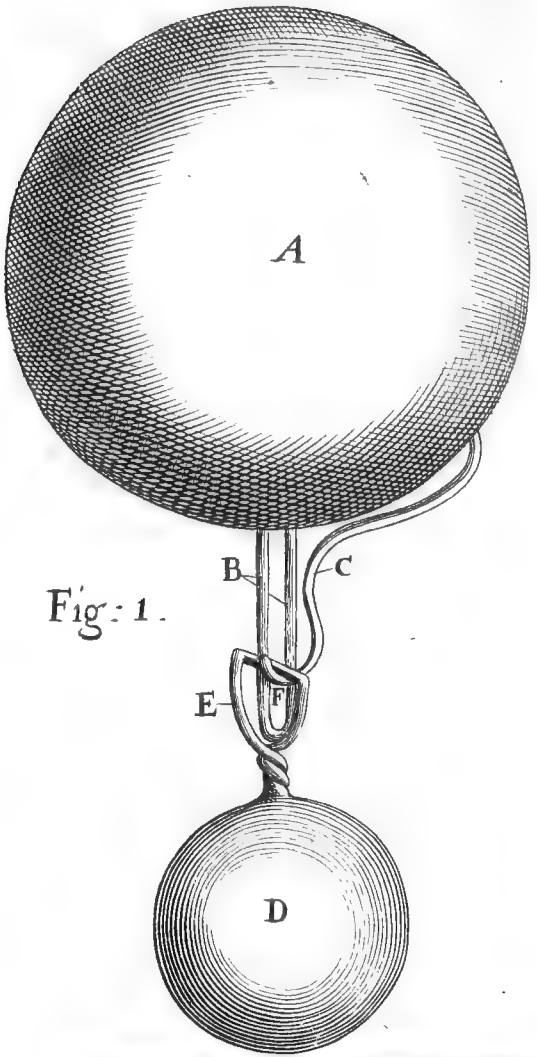
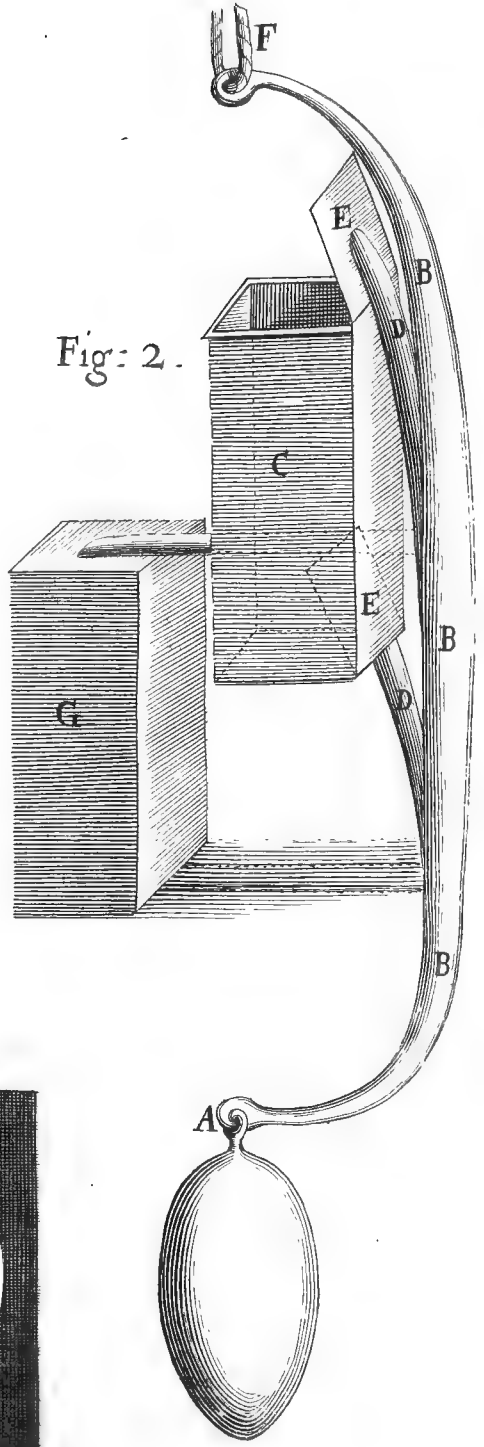


Fig: 1.



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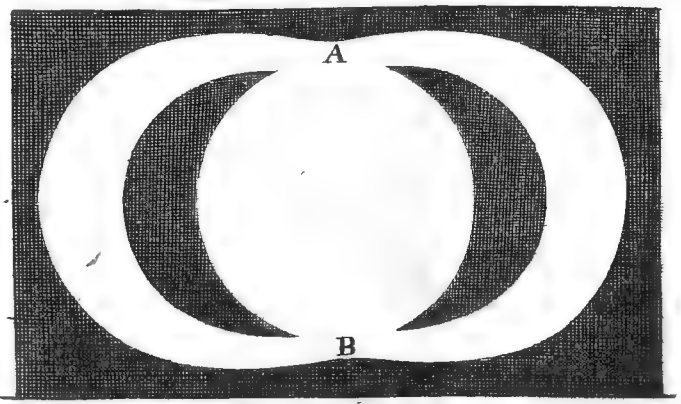

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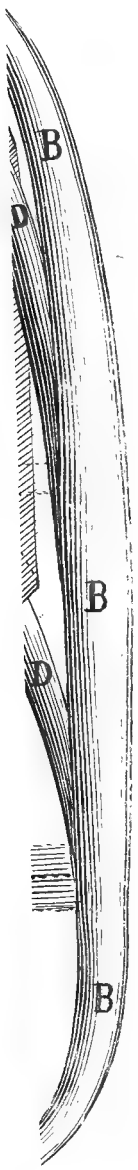
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PHILOSOPHICAL TRANSACTIONS.

Munday, Feb. 12. 166⅝.

The Contents.

An Apendix *to the* Directions *for Seamen, bound for far voyages. Of the judgment of ſome of the* Engliſh *Aſtronomers, touching the difference between two learned men, about an Obſervation made of the firſt of the two late* Comets. *Of a* Correſpondency, *to be procured, for the finding out of the* True *diſtance of the* Sun *and* Moon *from the Earth. Of an Obſervation not long ſince made in* England *of* Saturn. *An Account of ſome* Mercurial *Obſervations, made with a* Barometer, *and their Reſults. Some Obſervations of* Vipers, *made by an* Italian *Philoſopher.*

An Appendix *to the* Directions *for Seamen, bound for far Voyages.*

WHereas it may be of good uſe, both *Naval* and *Philoſophical*, to know, both how to ſound depths of the ſea *without a Line*, and to fetch up water from any depth of the ſame; the following waies have been contrived by Mr. *Hook* to perform both; (which ſhould have been added to the lately printed *Directions for Seamen*, if then it could have been conveniently done.)

Firſt, for the ſounding of depths without a Cord, conſider *Figure* 1, and accordingly take a Globe of *Firr*, or *Maple*, or other light Wood, as A: let it be well ſecured by Verniſh, Pitch, or otherwiſe, from imbibing water; then take a piece of Lead or Stone, D, conſiderably heavier then will ſink the Globe: let there be a long Wire-ſtaple B, in the Ball A, and a ſpringing Wire C, with a bended end F, and into the ſaid ſtaple, preſs in with your fingers the ſpringing Wire on the bended end: and on it hang the weight D, by its ring E, and ſo let Globe and all ſink gently into the water, in the poſture repreſented in the firſt *Figure*, to the bottom, where the weight D touching firſt, is thereby ſtopt; but the Ball, being by the *Impetus*, it acquired in deſcending, carried downwards a little after the weight is ſtopt, ſuffers the ſpringing wire to fly back, and thereby ſets it ſelf at liberty to reaſcend. And, by obſerving the time of the Ball's ſtay under water (which may be done by a Watch, having minuts and ſeconds, or by a good Minut-glaſs, or beſt of all, by a Pendulum vibrating ſeconds) you will by this way, with the help of ſome *Tables*, come to know any depth of the ſea.

Note, that care muſt be had of proportioning the weight and ſhape of the Lead, to the bulk, weight, and figure of the Globe, after ſuch a manner, as upon experience ſhall be found moſt convenient.

In ſome of the Tryals already made with this Inſtrument, the Globe being of Maple-wood, well covered with Pitch to hinder ſoaking in, was $5\frac{13}{16}$ inches in diameter, and weighed $2\frac{1}{2}$ pounds: the Lead of $4\frac{1}{2}$ pounds weight, was of a *Conical* figure, 11. inches long, with the ſharper end downwards, $1\frac{3}{16}$ inches at the top, and $\frac{1}{16}$ at the the bottom in diameter. And in thoſe Experiments, made in the *Thames*, in the depth of 19. foot water, there paſſed between the Immerſion and Emerſion of the Globe, 6. ſeconds of an hour; and in the depth of 10. foot water, there paſſed $3\frac{1}{2}$ ſeconds or thereabout: From many of which kind of Experiments it will likely not be hard to finde

out

out a method to calculate, what depth is to be concluded from any other time of the like Globes ſtay under water.

In the ſame Tryals, made with this Inſtrument in the ſaid River of *Thames*, it has been found, that there is no difference in time, between the ſubmerſions of the Ball at the greateſt depth, when it roſe two Wherries length from the place where it was let fall (being carried by the Current of the *Tide*) and when it roſe within a yard or ſo of the ſame place where it was let down.

The *other* Inſtrument, for Fetching up water from the depth of the ſea, is (as appears by *Figure* 2.) a ſquare woodden *Bucket* C, whoſe bottoms *EE*, are ſo contrived, that as the weight A, ſinks the Iron B, (to which the Bucket C, is faſtned by two handles DD, on the ends of which are the moveable bottoms or Valves EE,) and thereby draws down the Bucket; the reſiſtance of the water keeps up the Bucket in the poſture C; whereby the water hath, all the while it is deſcending, a clear paſſage through; whereas, as ſoon as the Bucket is pulled upwards by the Line F, the reſiſtance of the water to that motion beats the Bucket downward, and keeps it in the poſture G, whereby the Included water is preſerved from getting out, and the Ambient water kept from getting in.

By the advantage of which Veſſel; it may be known, whether ſea water be Salter at and towards the bottom, then at or near the top: Likewiſe, whether in ſome places of the ſea, any ſweet water is to be found at the bottom; the *Affirmative* whereof is to be met with in the *Eaſt Indian* Voyages of the induſtrious *John Hugh Van Linſchoten*, who page 16 of that Book, as 'tis *Engliſhed*, records, that in the *Perſian Gulph*, about the Iſland *Barem*, or *Baharem*, they fetch up with certain Veſſels (which he deſcribes not) water out of the ſea, from under the ſalt-water, four or five fathom deep, as ſweet, as any Fountain water.

Of the Judgement of ſome of the Engliſh *Aſtronomers, touching the difference between two learned men, about an Obſervation made of the Firſt of the two late* Comets.

Whereas notice has been taken in *Num.* 6. of theſe *Tranſactions*, that there was ſome difference between thoſe two deſervedly celebrated Philoſophers, *Monſieur Hevelius* and *Monſieur Auzout*, concerning an Obſervation, made by the former of them, on the $\frac{8}{18}$ of *February* 1665. & that thereupon ſome Eminent *Engliſh* Aſtronomers, conſidering the importance of the diſpute, had undertaken the examination thereof; it will, 'tis conceived, not be unacceptable to ſuch, as ſaw thoſe Papers, to be informed, what has been done and diſcerned by them in that matter. They having therefore compared the Printed Writings of the two Diſſenters, and withall conſulted the obſervations made with *Teleſcopes* at home, by ſome of the moſt intelligent Aſtronomers amongſt them, who have attentively obſerved the Poſition of that *Comet* to the *Teleſcopical* ſtars, that lay in its way; Do thereupon Joyntly conclude, that, whatever that Appearance was, which was ſeen near the *Firſt ſtar* of *Aries*, by *Monſieur Hevelius* (the truth of whoſe relation concerning the ſame, they do in no wiſe queſtion) the ſaid *Comet* did not come neer that *Star* in the left *Ear* of *Aries*, where the ſaid M. *Hevelius* ſuppoſes it to have paſſed, but took its courſe neer the *Bright Star* in its *Left Horn*, according to *Bayers* Tables. And ſince that the Obſervations of judicious both *French*, *Italian*, & *Dutch* Aſtronomers (as many of them, as are come to the knowledge of the *Engliſh*) do in the main fully agree with theirs, they do not at all doubt, but that, there being ſuch an unanimous con-

By Teleſcopical *Stars are underſtood ſuch, as are not ſeen, but by the help of a Teleſcope.*

conſent in what has been juſt now declared, & the Controverſie being about *Matter of fact*, wherein Authority, Number, and Reputation muſt caſt the Ballance, Monſ. *Hevelius*, who is as well known for his Ingenuity, as Learning, will joyn and acquieſce in that ſentiment.

Of a Correſpondency, to be procured, for the Finding out the True *diſtance of the* Sun *and* Moon *from the Earth, by the* Paralax, *obſerved under (or neer) the ſame* Meridian.

Seeing that the knowledge of this diſtance may prove of important uſe, for the Perfecting of Aſtronomy, and for the better eſtabliſhing the doctrine of *Refractions*; it is in the thoughts of ſome very curious Perſons in *England*, for the finding out the ſame, to ſettle a Correſpondency with ſome others abroad, that are underſtanding in Aſtronomical matters, and live in places farr diſtant in *Latitude*, and under (or near) the ſame *Meridian*.

To perform which, the following Method is propoſed to be obſerved; *viz.* That at certain times agreed on by two Obſervatours, making uſe of *Teleſcopes*, large, good and well fitted for this purpoſe, by a meaſuring rod, placed within the Eye-glaſs at a convenient diſtance, that it may be diſtinctly ſeen, and ſerve for meaſuring ſmall diſtances by minuts and ſeconds (which is eaſie enough in large *Teleſcopes*) that, I ſay, each of ſuch obſervers, thus furniſh't, ſhall obſerve the viſible way of the *Moon* among the *Fixt ſtars*, (by taking her exact diſtance from any *Fixt ſtarr*, that lyes in or very near her way, together with the exact time of her ſo appearing) and the then apparent Diameter of her Disk; continuing theſe Obſervations every time for two or three hours, that ſo,

if

if poſſible, two exact obſervations of her *Apparent* place among the *Fixt ſtars* being made, at two places thus diſtant in *Latitude*, and as near as may be under the ſame *Meridian*, by theſe Obſervators concurring at the ſame time, her true and exact diſtance may be hence collected, not onely for that time, but at all other times, by any ſingle Obſervator's viewing her with a *Teleſcope*, and meaſuring exactly her *Apparent* Diameter. It were likewiſe deſirable, that as often as there happens any conſiderable *Eclipſe* of the *Sun*, that this alſo might be obſerved by them, noting therein the exact meaſure of the greateſt Obſcuration compared with the then *Apparent* Diameter of his Disk. For by this means, after the diſtance of the *Moon* hath been exactly found, the diſtance of the *Sun* will eaſily be deduced.

As for the time, fitteſt for making Obſervations of the *Moon*, that will be, when ſhe is about a Quarter or ſomewhat leſs illuminated, becauſe then her light is not ſo bright, but that with a good *Teleſcope* ſhe may be obſerv'd to paſs cloſe by, and ſometimes over ſeveral *Fixt ſtars*; which is about four or five days before or after her Change: Or elſe at any other time, when the *Moon* paſſes near or over ſome of the bigger ſort of *Fixt ſtars*, ſuch as of the firſt or ſecond *Magnitude*; which may be eaſily calculated and foreſeen: Or beſt of all, when there is any *Totall Eclipſe* of the *Moon*; for then the ſmalleſt *Teleſcopical ſtars* may be ſeen cloſe adjoyning to the very body of the *Moon*. Of all which particulars the two Correſpondents are to agree, as ſoon as he, that is to joyn abroad, ſhall be found out; whereupon they are mutually to communicate to each other, what they ſhall have thus obſerved in each place.

Of an Obſervation, not long ſince made in England, *of* Saturn.

This Obſervation was made by Mr. *William Ball*, accompanied

panied by his brother, Dr. *Ball*, *October* 13. 1665. at ſix of the Clock, at *Mainhead* near *Exeter* in *Devonſhire*, with a very good *Teleſcope* near 38 foot long, and a double Eye-glaſs, as the obſerver himſelf takes notice, adding, that he never ſaw that *Planet* more diſtinct. The obſervation is repreſented by *Figure* 3. concerning which, the Author ſaith in his letter to a friend, as follows; This appear'd to me the preſent figure of *Saturn*, ſomewhat otherwiſe, than I expected, thinking it would have been decreaſing, but I found it full as ever, and a little hollow above and below. Whereupon the Perſon, to whom notice was ſent hereof, examining this ſhape, hath by Letters deſired the worthy Author of the *Syſteme of this Planet*, that he would now attentively conſider the preſent *Figure* of his *Anſes* or *Ring*, to ſee whether the appearance be to him, as in this *Figure*, and conſequently whether he there meets with nothing, that may make him think, that it is not *one* body of a Circular Figure, that embraces his *Diske*, but *two*.

And to the end that other Curious men, in other places might be engaged, to joyn their Obſervations with him, to ſee, whether they can find the like appearance to that, repreſented here, eſpecially ſuch Notches or Hollowneſſes, as at A and B, it was thought fit to inſert here the newly related Account.

A Relation of ſome Mercurial *Obſervations, and their Reſults.*

Modern *Philoſophers*, to avoyd Circumlocutions, call that Inſtrument, wherein a Cylinder of Quickſilver, of between 28. and 31. Inches in Altitude, is kept ſuſpended after the manner of the *Torricellian* Experiment, a *Barometer* or *Baroſcope*, firſt made publick by that Noble Searcher of Nature. Mr. *Boyle*, and imployed by Him and others, to detect all the minut variations in the Preſſure and weight of the Air. For the more curions

curious and nice diſtinguiſhing of which ſmall changes, Mr. *Hook* in the *Preface* to his *Micrography*, has deſcribed ſuch an Inſtrument with a *Wheel*, contrived by himſelf, and, by theſe two laſt years trials of it, conſtantly found moſt exact for that purpoſe: which being ſo accurate, and not difficult to be made, it were deſirable, that thoſe who have a Genius and opportunities of making Obſervations of this kind, would furniſh themſelves with ſuch of theſe Inſtruments, as were exactly made and adjuſted according to the Method, delivered in the newly mentioned place.

To ſay ſomething of the Obſervations, made by this Inſtrument, and withal to excite ſtudious *Naturaliſts* to a ſedulous proſecution of the ſame, the *Reader* may *firſt* take notice, that the lately named Mr. *Boyle* hath (as himſelf not long ſince did intimate to the Author of theſe *Tracts*) already made divers Obſervations of this kind in the year 1659. and 1660. before any others were publick, or by him ſo much as heard of; though he has hitherto forborn to divulge them, becauſe of ſome other Papers (in whoſe Company they were to appear) which being hindred by other ſtudies and employments, he hath not as yet finiſhed.

Next, that, beſides ſeveral others, who, ſince have had the curioſity of making ſuch obſervations, the Worthy and Inquiſitive Dr. *John Beal*, is doing his part with much aſſiduity (of which he hath by ſeveral Letters acquainted his Friends in *London*) both by obſerving himſelf, and by procuring many Correſpondents in ſeveral places in *England* for the ſame purpoſe; judging it of great importance, that Obſervations of this kind be made in parts ſomewhat diſtant from one another, that ſo from many of thoſe, accurately made and then compared, it may be diſcovered, whether the Aire gravitates more in the parts of the Earth lying more *Eaſt* or *Weſt*, *North* or *South*? whether on ſuch as lie neerer to the *Sea*, or further up into the *Main land*? in hotter or colder weather? whether in high

high Winds or Calms? whether in wet weather or dry? whether moſt when a North, or when a South, when an Eaſt or a Weſt wind blows? and whether it keeps the ſame ſeaſons of Changes? and whether the ſeaſons and changes of the Air and Weather can be thereby diſcover'd, and the now hidden cauſes of many other *Phænomena* detected?

The ſaid *Doctor* is ſo much pleaſed with the diſcovery already made by the help of this Inſtrument, that he thinks it to be one of the moſt wonderful that ever was in the World, if we ſpeak of ſtrangeneſs, and juſt wonder, and of Philoſophical importance, ſeparate from the intereſt of lucre. For (*ſaith he, in one of his Letters*) who could ever expect, that we men ſhould find an Art, to weigh all the Air that hangs over our heads, in all the changes of it, and, as it were, to weigh, and to diſtinguiſh by weight, the Winds and the Clouds? Or, who did believe, that by palpable evidence we ſhould be able to prove, the *ſereneſt* Air to be moſt heavy, and the *thickeſt* Air, and when darkeſt Clouds hang neereſt to us, ready to diſſolve, or dropping, *then* to be lighteſt. And though (*ſo he goes on*) we cannot yet reach to all the Uſes and Applications of it; yet we ſhould be entertain'd for a while, by the truly Honourable Mr. *Boyle*, as the leading perſon herein, upon the delight and wonder. The *Magnet* was known many hundreds of years before it was applied to find out *New Worlds*. To me (*ſaith he*) tis a wonderful delight, that I have alwaies in my Study before my eye ſuch a *Curious Ballance*.

Having thus in *General* expreſſed his thoughts about this Invention, and the ſingular pleaſure, he takes in the Obſervations made therewith, he deſcends to particulars, and in ſeveral Letters communicates them to his Correſpondent, as follows:

1. My *Wheel-barometer* I could never fill ſo exactly with *Mercury*, as to exclude *all* Air; and therefore I truſt more

The Excluſion of all *Air is here neceſſary, becauſe Air being ſubject to the operation of Heat and Cold, if any of it remain in the* Barometer, *it will cauſe it to vary from ſhewing the true Preſſure of the Air.*

to a *Mercurial* Cane, and take all my Notes from it, This Cane is but 35. Inches long, of a very ſlender Cavity, and thick Glaſs. This may eaſily be conveyed to any place, for Trials. The Veſſel for the ſtagnating *Mercury*, into which the ſaid Cane is immerſed, is about two *Inches* wide. The *Mercury* ſo well fill'd, that for ſome daies it would not ſubſide, but hung to the top of the Glaſs-cane. I keep it in a Cloſet pretty cloſe, 9. foot high, 8. foot broad, 15. foot long; neer a Window. This I note, becauſe poſſibly the cloſeneſs of the room may hinder, that it gives not the full of all Changes, as it might in a more paſſable Air.

2. In all my Obſervations from *May* 28. 1664 to this preſent (*December* 9. 1665.) the Quickſilver never aſcended but very little above 30¼ Inches.

3. It aſcended very ſeldom ſo high (*videl.* to 30¾ Inches) chiefly in *Decemb.* 13. 1664. the weather being fickle fair, Evening.

4. I find by my *Calender* of *June* 22. 1664. at 5. in the Morning, in a time of long ſetled fair weather, that the *Mercury* had aſcended about half an Inch higher then 30: but I fear ſome miſtake, becauſe I then took no impreſſion of *wonder* at it; yet for 3. or 4. daies, at that time it continued high, in well-ſetled, fair and warm weather; moſt part above 30. Inches. So that I may note, the *Mercury* to riſe as high in the hotteſt *Summer*, as in the coldeſt *Winter-weather*.

5. Yet ſurely I have noted it aſcend a little higher for the Coldneſs of the Weather; and very frequently, both in Winter

Perhaps this is from some included Air,

ter and Summer to be higher in the cold Mornings and Evenings, then in the warmer Mid-day.

6. Generally in ſetled and fair weather both of Winter and Summer, the *Mercury* is higher, than a little *before* or *after*, or *in* Rainy weather.

7. Again, generally it deſcended lower after Rain, than it was before Rain.

8. Generally alſo it falls in great winds; and ſomewhat it ſeem'd to ſink, when I open'd a wide door to it, to let in ſtormy winds; yet I have found it to continue very high, in a long ſtormy wind of 3. or 4. daies.

It ſeems theſe were Eaſterly *winds.*

9. Again, generally it is higher in an *Eaſt* and *North*-wind. (*Cæteris paribus*) than in a *South* and *Weſt*-wind.

10. I tryed ſeveral times, by ſtrong fumes and thick ſmoaks to alter the Air in my Cloſet; but I cannot affirm, that the *Mercury* yielded any more, then might be expected from ſome increaſe of heat. Such as have exact *Wheel-Barometers*, may try whether Odors or Fumes do alleviate the Air.

11. In this Cloſet I have not in all this time found the extreameſt changes of the Quickſilver to amount to more, than to $2\frac{1}{4}$, or to $2\frac{1}{8}$. inches, at moſt.

12. Very often I have found great changes in the Air, without any perceptible change in the *Barometer*; as in the dewy nights, when the moiſture deſcends in a great quantity, and the thickneſs ſometimes ſeems to hide the Stars from us: In the days foregoing and following, the Vapors have been

drawn up ſo *Inviſibly*, that the Air and Sky ſeem'd very clear all day long. This I account a great change between aſcending and deſcending Dews and Vapors (which import Levity and Weight,) and between thick Air and clear Air: which changes do ſometimes continue in the Alternative courſe of day and night, for a week or fortnight together; and yet the *Baroſcope* holding the ſame.

12. Sometimes (I ſay not often) the *Baroſcope* yields not to other very great changes of the Air. As lately (*December* 18.) an extraordinary bright and clear day; and the next following quite darkned, ſome Rain and Snow falling; but the *Mercury* the ſame: ſo in high winds and calms the ſame.

14. I do conceive, that ſuch as converſe much *Sub dio*, and walk much abroad, may find many particulars much more exactly, then I, who have no leiſure for it, can undertake. To inſtance in one of many, *December*. 16. laſt, was a clear cold day, very ſharp and ſtrong *Eaſt* wind, the *Mercury* very near 30. inches high, about three in the afternoon, I ſaw a large black cloud, drawing near us from the *Eaſt* and *South-Eaſt*, with the *Eaſt-wind*. The *Mercury* changed not that day nor the day following; the Stars and moſt of the sky were very bright and clear till Nine of the Clock; and then ſuddenly all the sky was darkned, yet no change of weather happened; *December* 17. the froſt held, and 'twas a clear day, till about two of the clock in the afternoon; and then many thick clouds appear'd low in the *Weſt*; yet no change of the weather here; the Wind, Froſt, and Quick-ſilver, the ſame, *December* 18. the *Mercury* fell almoſt $\frac{1}{4}$ of an inch, and the sky and Air ſo clear and bright and cold with an *Eaſt-wind*, that I wondred what could cauſe the *Mercury* to deſcend. I Expected, it ſhould have aſcended, as uſually it does in ſuch clear skys. Caſually I ſent my ſervant abroad, and he diſcovered the remote Hills, about 20. miles off, cover'd with

ſnow

ſnow, This ſeem'd to manifeſt, that the Air, being diſcharged of the clouds by ſnow, became lighter.

15. I have ſeldom ſeen the change to be very great, at any one time. For, though I do not now take a deliberate view of my Notes, yet I wonder'd once to ſee, that in one day it ſubſided about $\frac{3}{4}$ of an inch.

16. Of late I have altered my Method upon the *Barometer*, obſerving it, as it is before my Eyes, all day long, and much of the night, being watchful for the moments of every particular change, to examine, what cauſe in the Air and Heavens may appear for ſuch changes. And now my wonder is, to ſee, how ſlow it is, it holding moſt between the nine and twentieth and thirtieth inch of late.

17. I muſt now (*January* 13. $166\frac{5}{6}$) tell you, that the *Mercury* ſtands at this time (as it did alſo yeſterday) a quarter above 30. inches; yet both days very dark and cloudy, ſometimes very thick and miſty Air; which ſeldom falls out. For, for the moſt part, I ſee it higher in cleareſt ſetled weather, than in ſuch cloudy and miſty Foggs. This thick Air and darkneſs hath laſted above a week; lately more Cold, and *Eaſt* and *North-Eaſt* wind.

Thus far the Notes of this Obſerving *Divine*; of which Mr. *Boyle*, to whom they were alſo communicated, entertains theſe thoughts, that they ſeem to him very faithfully made, and do for the main, agree well enough with his obſervations, as far as he remembers, not having them, it ſeems, at that time, when he wrote this, at hand; and though it be wiſhed by him, that the Obſerver's Glaſs-Cane had been ſomewhat bigger; yet his diligence in fitting it ſo carefully, or rather ſo skilfully, as is above-mentioned, is much by him commended.

This ſeems to be wiſhed, becauſe the motion of the Mercury *may be more free in a wider Cane.*

Some

Some Obſervations of Vipers.

A curious *Italian*, called *Franceſco Redi*, having lately had an opportunity, by the great number of Vipers, brought to the *Grand Duke* of *Toſcany* for the compoſing of *Theriac* or *Treacle*, to examine what is vulgarly delivered and believed concerning the Poyſon of thoſe Creatures, hath, (according to the account, given of it in the French *Iournal des Scavans*, printed *Ianuary* 4. 166$\frac{5}{6}$) performed his undertaking with much exactneſs, and publiſh'd in an Italian tract, not yet come into *England*, theſe Obſervations.

1. He hath obſerved, that the poyſon of Vipers is neither in their *Teeth*, nor in their *Tayle*, nor in their *Gall*; but in the two *Veſicles* or *Bladders*, which cover their teeth, and which coming to be compreſſed, when the Vipers bite, do emit a certain yellowiſh Liquor, that runs along the teeth and poyſons the wound. Whereof he gives this proof, that he hath rub'd the wounds of many Animals with the *Gall* of Vipers, and pricked them with their *Teeth*, and yet no conſiderable ill accident follow'd upon it, but that as often as he rubbed the wounds with the ſaid yellow Liquor, not one of them eſcaped.

2 Whereas commonly it hath hitherto been believed, that the poyſon of Vipers being ſwallowed, was preſent death; this *Author*, after many reiterated Experiments, is ſaid to have obſerved, that in Vipers there is neither Humour, nor Excrement, nor any part, not the *Gall* it ſelf, that, being taken into the Body, kills. And he aſſures, that he hath ſeen men eat, and hath often made Bruit Animals ſwallow all that is eſteem'd moſt poyſonous in a Viper, yet without the leaſt miſchief to them. Whence he ſhews, that it needs not ſo much to be wondred at, that certain *Empiricks* ſwallow the juyce of the moſt

moſt venomous Animals without receiving any harm thereby; adding, that, which is aſcribed to the vertue of their *Antidote*, ought to be attributed to the nature of thoſe kinds of Poyſons, which are no poyſons, when they are ſwallow'd, (for which Doctrine he alſo alledges *Celſus*) but onely when they are put into wounds. Which alſo has been noted by *Lucan*, who introduces *Cato* thus ſpeaking;

Noxia ſerpentum eſt admiſto ſanguine peſtis,
Morſu *virus habent*, & *fatum* dente *minantur*;
Pocula *morte carent.*

And what alſo ſome Authors have affirm'd, *videl.* That it is mortal, to eat of the Fleſh of creatures killed by Vipers; or to drink of the VVine wherein Vipers have been drowned; or to ſuck the wounds that have been made by them, is by this Authour obſerved to be wide of truth. For he aſſures, that many perſons have eaten Pullets and Pigeons, bitten by Vipers, without finding any alteration from it in their health. On the contrary, he declares, That it is a ſoveraign Remedy againſt the biting of Vipers, to ſuck the wound; alledging an Experiment, made upon a Dog, which he cauſed to be bitten by a Viper at the noſe, who by licking his own wound ſaved his life. Which he confirms by the example of thoſe people, celebrated in *Hiſtory* by the name of *Marſi* and *Pſilli*, whoſe Employment it was, to heal thoſe, that had been bitten by Serpents, by ſucking their wounds.

3. He adds, that although *Galen* and many modern *Phyſitians* do affirm, that there is nothing, which cauſeth ſo much thirſt, as Vipers-fleſh, yet he hath experimented the contrary and known divers perſons, who did eat the fleſh of Vipers at all their meals, and yet did aſſure him, they never were leſs dry, then when they obſerved that kind of Diet.

4. As for the Salt of Vipers, whereof ſome *Chymiſts* have

ſo

ſo great eſteem, he ſaith, that it hath no *Purging* vertue at all in it: adding that even of *All Salts*, none hath more vertue than another, as he pretends to have ſhew'd in an other *Book* of his, *De natura ſalium*; which alſo hath not been yet tranſmitted into theſe parts.

5. He denies, what *Ariſtotle* aſſures, and what *Galen* ſaith to have often tryed, that the *Spittle* of a *Faſting* perſon kills Vipers, and he laughs at many other particulars, that have been delivered concerning the *Antipathy* of Vipers unto certain things; and their manner of Conception and Generation, and ſeveral other properties, commonly aſcribed to them; which the alledged French Author affirms to be refuted by ſo many experiments made by this *Italian* Philoſopher, that it ſeems to him, there is no place left for doubting, after ſo authentick a teſtimony.

Advertiſement.

THe *Reader* of theſe *Tranſactions* is deſired to correct theſe *Errata* in *Number* 8. *viz.* page. 132. line penult. read *Wine* for *Lime*; and page 133. line 10. read *Threſher* for *Trepher*, as ſome *Copies* have it; and page 136. line ult. read *puriſie* for *putriſie*.

LONDON,
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PHILOSOPHICAL TRANSACTIONS.

Munday, *March* 12. 166⅝.

The Contents.

Obſervations continued upon the Barometer, *or* Ballance of the Air. *A Relation concerning the* Earth-quake *neer* Oxford; *together with ſome Obſervations of the ſealed* Weatherglaſs *and* Barometer *thereupon by* Dr. Wallis. *A more full and particular Account of thoſe Obſervations about* Jupiter, *that were mention'd in Numb.* 8. *An Account of ſome Books, lately publiſht*, videl. *Mr.* Boyles *Hydroſtatical Paradoxes*; Steno *de Muſculis & Gladulis*; De Graeff *de Natura & Uſu Succi Pancreatici.*

Obſervations continued upon the Barometer, *or rather* Ballance of the Air.

THeſe *Tranſactions* being intended, *not only* to be (by parcels) brief Records of the Emergent Works and Productions in the Univerſe; Of the Myſteries of Nature of later diſcoveries; And, of the growth of Uſeful Inventions and Arts; *but* alſo, and chiefly, to ſollicite in all parts mutuall Ayds and Collegiate endeavours for the farther advancement thereof: We ſhall begin this *Second* year of our Publications in this kind (in which, for 3 moneths the Printing-preſſes were interrupted by the publick Calamity) with a few more particular Obſervations upon the *Ballance of the Air*, as they are moſt happily invented and directed by Mr. *Boyle*; and deſerve to be proſecuted with care and diligence in all places.

But it is to be premiſed, that that Worthy perſon, who was alledged as the Author of the Obſervations, delivered of this kind in the laſt of theſe *Tracts* (Dr. *Beale*) gives notice, That he

he did not pretend to exactneſs, but only to excite the carefulneſs of others in the ſeveral diſtant places, and chiefly ſuch, as can have the aſſiſtance of a *Wheel-ballance* perfectly filled: without both which aids he hopes not to obtain all the benefits and myſteries of this Invention.

This being thus briefly intimated, the Account of the Obſervations themſelves, as they were extracted out of a late Letter of the ſame Perſon, are, as followes:

1. As I have fitted and filled the *Single Cane*, I can ſay in the general, That I have not yet found any ſuch infallible Prognoſtick of theſe changes of weather, which do follow a long ſerenity, or ſetled weather. And perchance in brighter Climats it may be conſtantly infallible. In theſe *Northern Iſlands*, the Clouds are ſo ſhort, and narrow, and by fickle changes are ſometimes emptied upon us, ſometimes ſo neer, as may make ſo little variation in the weight of the whole Atmoſphere of Air, as may ſometimes deceive us, or ſmother and hide from us the cauſes of fixedneſs, or of changes. I wiſh I could ſee a good *Calender* or *Journal* taken in *Tangier*, and in ſome of our *Northern* and moſt *Southern* parts of *America*. I have ſtore of *Hygroſcopes* of divers kinds, and I do remark them, and the ſweatings of Marble, and as many other famed Prognoſticks, as I can hear off; but can find nothing ſo neerly indicative of the change of weather, as this *Ballance*. Thoſe others are often changed by Dews, which do not at all alter the *Ballance*, nor alter the ſtate of the weather: And the open Weather-glaſs is known to ſignifie nothing at certainty, having a double obedience to two Maſters, ſometimes to the *Weight of the Air*, ſometimes to *Heat*, as the ſervice is commanded.

Hygroſcopes *are Inſtruments, to diſcover the degrees of Moiſture and Drought of the Air.*

2. And in further confirmation of this Note, I may adde to the former, That in *January* laſt $166\frac{5}{6}$, from the *fourth*, and more eſpecially from the *ſeventh* day, for many daies it continued very dark, ſo that all men expected daily great rain; yet the *Mercury* held very high, neer to the greateſt height; And though in thoſe daies ſometimes thick miſts aroſe and ſome ſmall rain fell, yet the *Quick-ſilver* held at a great height: which did indicate to me, there could *then* be no great change of weather. As the ſmall rain fell, it yeilded ſomewhat, not much; and that does more con-

confirm the indication. And more lately, in very dark daies, I had the ſame confidence upon the ſame ground, and I was not diſappointed.

3. Again, if the *Mercury* aſcends to a good height after the fall of rain (as ſometimes, but leſs often it does) then I look for a ſetled ſerenity; but if it proceeds after rain in a deſcending motion, then I expect a continuance of broken and ſhowry weather. But in all, as I only ſay, *For the moſt part*, ſo I dare not poſitively declare it an affirmative reſult, but do refer it to the remarks of others. And this may explicate the Notes 6. and 14. of *Num.* 9. into more clearneſs.

4. That we find the Weather and our Bodies more chill, cold, and drooping, when the *Mercury* is loweſt, and the Air lighteſt, beſides other cauſes, I gueſs, That as Air is to us the breath of life, as water is to Fiſhes; ſo, when we are deprived of the uſual meaſure of this our food, 'tis the ſame to us, as when the water is drawn ebb from Fiſhes. But I would much rather be inſtructed by others, then offer much in this kind.

5. The loweſt deſcent of the *Mercury* in all the time, ſince I have obſerved it, was *Octob.* 26. 1665. in the Evening, when it was very near at 27 ½ Inches. Which I find thus circumſtanced with the weather in my notes.

Inch.

Oct. 25. Morning; *Mercury* at 28½. Great ſtorms and much rain.
Oct. 26. Morning; *Merc.* at 28. winds quiet, thick dark clouds.
Oct. 26. Evening; *Merc.* at 27½. That day, and ſome daies following, the weather was variable, frequent rain, and as you ſee, the *Mercury* lower, than uſual.

6. Over the place, where this *Mercurial Cane* ſtands, I have ſet a *Wind vane*, with purpoſe of exactneſs, of a Streamer in Braſs ſo large, and pointing to a Board indented in the Margin, that I can at a ſure Level upon the *Vane*, take every of the 32. points of the Wind, half points, and quarter points, at good diſtance. Otherwiſe we may find our gueſſes much deceived, as the beſt gueſſers, upon trial, do acknowledge. And this exactneſs may become the *Wheel-ballance*, which ſhews the minuteſt variations almoſt beyond imagination. And thus any ſervant, at the approach of a thick Cloud, or other *Meteor*, higher or lower, or at the riſing of a ſtorm or freſh wind in the night, or day, may bring a report of the Weight of the Air, as certainly and almoſt as

eaſily, as of the Sun from the *Dial* in a Sunſhine. It were good to have an *Index* of Winds, that diſcover'd as well their Aſcent and Deſcent, as their Side-coaſtings.

A Relation concerning the late Earthquake *neer* Oxford *; together with ſome Obſervations of the ſealed Weatherglaſs, and the Barometer, both upon that* Phænomenon, *and in* General.

This Relation was communicated by the excellently learned Dr. *Wallis*, as follows:

On the 19. of *January* 1665. *Stylo Angliæ* (or *Jan*, 29. 1666. *ſtylo novo*) at divers places neer *Oxford*, was obſerved a ſmall *Earthquake* (as at *Blechington*, *Stanton-St. Johns*, *Bril*, &c.) towards evening. In *Oxford* it ſelf, I doe not hear, that it was obſerv'd to be an Earthquake; yet I remember about that time (whether preciſely then or not, I cannot ſay) I took notice of ſome kind of odde ſhaking or heaving, I obſerved in my ſtudy, but did impute it to the going of Carts or Coaches, ſuppoſed to be not far off; though yet I did take notice of it, as a little differing from what is uſual on ſuch occaſions; (and wondered the more, that I did not hear any:) But not knowing, what elſe to refer it to, I thought no more of it. And the like account I have had from ſome others in *Oxford*, who yet did not think of an Earth quake; it being a rare thing with us. Hearing afterwards of an Earthquake obſerved by others; I looked on my Notes concerning my *Thermoſcope* and *Baroſcope*, to ſee if any alteration conſiderable had then happened.

My *Thermoſcope* conſiſts of a round large Glaſs, containing about half a pint or more; from whence iſſues a long Cylindrical neck of Glaſs, about two foot and a half in length, and leſs than a quarter of an inch diameter; which neck was *hermetically* ſealed at the top, to exclude communication with the External Air; but before the ſealing of it, the whole Glaſs was filled with *ſpirit of Wine* (tinged with *Cochineel*, to make it the more diſcernable to the Eye) ſo warmed, that it filled the whole content of the Glaſs; but afterwards, as it cooled, did ſo ſubſide, as to leave a void ſpace in the upper part of the Neck. Which Inſtrument, ſo prepared, doth by the riſing or falling of the tinged liquor in the neck (conſequent upon the expanding or contracting of the whole liquor contained in it and the Ball below) give a very nice account of the Temperature of the Air,

as

as to *Heat* or *Cold*: Even ſo nice, as that my being or not being in my Study I find to vary its hight ſometimes almoſt a quarter of an inch.

My *Baroſcope*, I call another Inſtrument for eſtimating the *Weight* or *Preſſure* of the Incumbent Air, conſiſting of a long *Glaſs-tube* of about 4. foot in length, and about a quarter of an inch Bore: which tube (*hermetically* ſealed at the one end) being filled with Quickſilver (according to the *Torricellian* Experiment) is inverted, ſo as to have the open end of it immerſed in Stagnant Quickſilver, contained in a larger Glaſs under it, expoſed to the preſſure of the outward Air: Out of which open end (after ſuch immerſion) the Quickſilver in the Tube being ſuffered to run out, as much as it will, into the Stagnant Quickſilver, in which that mouth or open end is immerſed, there is wont to remain (as is commonly known to thoſe acquainted with this Experiment) a Cylinder of Quickſilver ſuſpended in the Tube, about 28, 29, or 30. inches high; meaſuring from the ſurface of the Stagnant Quickſilver perpendicularly; (but more or leſs, within ſuch limits, according as the Weight or Preſſure of the Air incumbent on the External Stagnant Quickſilver expoſed to it, is greater or leſs:) leaving the upper part of the Tube void. (Both which Inſtruments being the contrivance of the Honourable *Robert Boyle*, they are by him more particularly deſcribed in his *Phyſico-Mechanical Experiments touching the Air, Exper.* 17. and 18. and in his *Thermometrical Diſcourſes*, premiſed to his *Hiſtory of Cold.*)

Now, according to both theſe Inſtruments, having kept a daily *Regiſter* of Obſervations for more than a whole year (ſaving when I have been for ſome ſhort time abſent from home) I find my Notes for that day to be theſe.

January. Day. Hour.	*Thermoſcope.* inches.	*Baroſcope.* inches.	$166\frac{5}{6}$.	
19. 8. Morn.	14 $\frac{1}{16}$.	29 $\frac{1}{2}$.	Hard froſt.	Cloſe.
4. Even.	14 $\frac{3}{8}$.	29 $\frac{1}{4}$.	Hard froſt.	Cloudy.
9. Even.	14 $\frac{3}{4}$.	29 $\frac{3}{4}$.	Rain.	Wind
20. 8. Morn.	15 $\frac{1}{4}$.	28 $\frac{3}{4}$.	Sunſhine.	Wind.

So that, there being in the morning (*January* 19.) a hard froſt (which began the day before about 4. of the Clock in the afternoon

noon(*Jan.* 18.)and continued(with us)till about 5. of the Clock in the afternoon of that day, *Jan.* 19. with ſome fierceneſs) and the weather, *Jan.* 19. being in the morning, cloſe; and cloudy all the day, with little of Sun-ſhine; the Liquor in the *Thermoſcope* was very little raiſed, by 4. of the Clock afternoon, that is, but $\frac{5}{16}$ of an inch (which, had the Sun ſhone, would, it's likely, have been near an Inch:) and after that time(or ſomewhat before) had there been no conſiderable change of weather, it would upon the Sun's ſetting have fallen (and probably ſo it did, till about 5. of the Clock, though I took no Obſervation in the interim.) But, contrary to what would have been expected, it was at 9. of the Clock at night, higher by $\frac{1}{8}$ of an inch, than it had been at 4. occaſioned by the change of weather, the Froſt ſuddenly breaking, with us, between 5. and 6. of the Clock; about which time alſo it began to rain, and continued raining that Evening and good part of the Night. And the next morning I found the Liquor yet higher by half an inch, *vid.* $15\frac{1}{4}$ inches: (by reaſon of the Air that night being ſo much warmer, than it had been the day before;) whereas commonly it is conſiderably lower in the morning, than over night.

As to the *Baroſcope*, for the Weight or Preſſure of the Air; I find, that for the 11, 12, 13, 14, 15, 16, and 17. dayes, the *Mercury* in the Tube, was (by the ballancing Preſſure of the incumbent Air on the ſtagnant Quickſilver, expoſed to it) kept up to the height of near 30. Inches above the ſurface of the External Quickſilver, (though with ſome little variation, as 30, $29\frac{15}{16}$, $29\frac{7}{8}$, $29\frac{13}{16}$ but never ſo low, all that time, as $29\frac{3}{4}$;) which is the greateſt height I have know it at, (for I do not find, that I have ever, till then, obſerved it to be, in my Glaſſes, full 30. Inches, though it have been very near it: the Weather having been almoſt continually Foggy, or very thick Miſts, all that time. *January* 18. it came down to $29\frac{3}{4}$, in the forenoon; and afternoon to $29\frac{11}{16}$. about the time the froſt began: And *Jan.* 19. it was, at 8. in the morning, come down to $29\frac{1}{2}$; at 4. in the afternoon, to $29\frac{1}{4}$. But at 9. in the evening(when the Earth quake had intervened) it was riſen half an inch, *vid.* to $29\frac{3}{4}$. And, by the next morning, fallen again a whole inch, *vid.* to $28\frac{3}{4}$; which fall I attribute (at leaſt in part) to the rain that fell in the night.

This being what I obſerved out of my *Regiſter* of theſe Inſtruments, (which, if I had then thought of an Earthquake, I

ſhould

ſhould have more nicely watched) what I have further gathered from Reports, is to this purpoſe.

I hear, it was obſerved at *Blechington*, above 5. miles to the *North* of *Oxford*, and ſo along by *Boſtol*, *Horton*, *Stanton-St. Johns*, and ſo towards *Whately*, which is about 4. miles *Eaſtward* from *Oxford*. Not at all theſe places at the ſame time, but moving forward from *Blechington* towards *Whately*. For it was at *Stanton* about 6. of the Clock or later (as I underſtand from Mr. *Boyle*, who was there at that time;) but had been at *Blechington* a good while ſooner. And I am told, that it was taken notice of by Doctor *Holder* (a Member of our *Society*) who was then at *Blechington*, to be obſerved by thoſe in the further part of the Garden, ſome very diſcernable time before it was obſerved by thoſe in the Houſe; creeping forward from the one place to the other. What other places in the Country it was obſerved at, I have not been informed: but at *Oxford* (which, it ſeems, was about the skirts of it) it was ſo ſmall, as would have been hardly noted at all, had not the notice, taken of it abroad, informed us of it.

Upon this Occaſion, it will not be unſeaſonable to give ſome General accounts of what I have in my *Thermoſcope* and *Baroſcope* obſerved.

My *Thermoſcope*, being fitted ſomewhat at adventures, I have found at the loweſt to be ſomewhat more than 12. inches high, in the fierceſt time of the long Froſt in the beginning of the laſt year 1665. and about 27 Inches high, at the higheſt, in the hotteſt time of the laſt Summer: (which I mention, that it may appear at what temperature in proportion, the Air was at the time above-mentioned.) But I muſt add withall, that this ſtanding ſo, as never to be expoſed to the Sun, but in a room, that has a window only to the North, it would have been raiſed much higher than 27. inches, if it were put in the hot Sun-ſhine in Summer; this, as it is placed, giving therefore an account onely of the Temperature of the Air in *general*, not of the immediate heat of the Sun-ſhine.

This Inſtrument, thus ſituated, when it is about 15. inches, or lower, is for the moſt part hard froſt; but ſeldom a froſt, if higher than 16. Yet this I have often obſerved, that the Air by the *Thermoſcope* has appeared conſiderably colder (and the liquor lower) at ſometimes when there is no Froſt, than at ſome other times, when the Froſt hath been conſiderably hard. In

In my *Baroſcope*, I have never found the Quickſilver higher than 30. inches, nor lower than 28. (at leaſt, ſcarce diſcernably, not $\frac{1}{16}$ of an inch higher than *that*, or lower than *this*:) which I mention, not only to ſhew the limits, within which I have obſerved mine to keep, *vid.* full 2 inches, but likewiſe as an Eſtimate of the Clearneſs of the Quickſilver from Air. For, though my Quickſilver were with good care cleanſed from the Air; yet I find that which Mr. *Boyle* uſeth, much better: for, comparing his with mine at the ſame times, and both in *Oxford*, at no great diſtance; I find his Quickſilver to ſtand alwaies ſomewhat higher than mine (ſometimes neer a quarter of an Inch;) which I know now how to give a more probable account off, than that my Quickſilver is either heavier than his; or elſe, that his is better cleanſed from Air; (unleſs, poſſibly, the difference of the Bore, or other circumſtances of the Tube, may cauſe the alteration; mine being a taller Tube, and a bigger Bore, than his.) And upon like reaſon, as his ſtands higher than mine; ſo another, leſs cleanſed from Air, may at the ſame time be conſiderably lower, and conſequently under 28. Inches at the loweſt.

In *thick foggy* weather, I find my Quickſilver to riſe; which I adſcribe to the heavineſs of the Vapours in the Air. And I have never found it higher, than in the foggy weather above-mentioned.

In *Sunſhiny* weather, it riſeth alſo (and commonly the clearer, the more;) which, I think, may be imputed *partly* to the Vapors raiſed by the Sun, and making the Air heavier; and *partly* to the Heat, increaſing the Elaſtick or Springy power of the Air. Which latter I the rather add, becauſe I have ſometimes obſerved in Sunſhiny weather, when there have come Clouds for ſome conſiderable time (ſuppoſe an hour or two) the Quickſilver has fallen; and then, upon the Suns breaking out again, it has riſen as before.

In *Rainy* weather, it uſeth to fall (of which the reaſon is obvious, becauſe the Air is lightned, by ſo much as falls:) In *Snowy* weather, likewiſe, but not ſo much as in *Rain*. And ſometimes I have obſerved it, upon a *Hoar-froſt*, falling in the night.

For *Windy* weather, I find it *generally* to fall; and that more univerſally, and more diſcernably, than upon Rain: (which I attribute to the Winds moving the Air *collaterally*, and thereby not ſuffering it to preſs ſo much *directly* downwards: the like of which

which we ſee in ſwimming, &c.) And I have never found it lower than in high Winds. *

I have divers times, upon diſcerning my Quickſilver to fall without any viſible cauſe at home, looked abroad; and found (by the appearance of broken Clouds, or otherwiſe) that it had rained not far off, though not with us: Whereupon, the Air being then lightened, our heavier Air (where it rained not) may have, in part, diſcharged it ſelf on that lighter.

*The Author of theſe Obſervations intends hereafter more particularly to obſerve, from what points thoſe Winds blow, that make the Quickſilver thus ſubſide.

A more particular Account of thoſe Obſervations about Jupiter, *that were mentioned in* Numb. 8.

Since the publiſhing of *Numb.* 8. of theſe *Tranſactions*, where, among other particulars, ſome ſhort Obſervations were ſet down touching both the *Shadow* of one of *Jupiter*'s *Satellits*, paſſing over his Body, and that *Permanent Spot*, which manifeſts the Converſion of that Planet about his own *Axis*; there is come to hand an *Extract* of that Letter, which was written from *Rome*, about thoſe Diſcoveries, containing an ample and particular Relation of them, as they were made by the Learned *Caſſini*, Profeſſor of *Aſtronomy* in the Univerſity of *Bononia*. That *Extract*, as it is found in the *French Journal des Scavans* of *Febr.* 22. 1666. we thus *Engliſh*.

Monſieur *Caſſini*, after he had diſcovered (by the means of thoſe Excellent Glaſſes of 50. *palmes*, or 35. *feet*, made by M. *Campani*) the *Shadows*, caſt by the 4 Moons or *Satellits* of *Jupiter* upon his Diske, when they happen to be between the Sun and Him; after he had alſo diſtinguiſhed their Bodies *upon* the Diske of *Jupiter*; made the laſt year ſome Prædictions for the Months of *Auguſt* and *September*, noting the dayes and hours, when the Bodies of the ſaid *Satellits* and their *Shadows* ſhould appear upon *Jupiter*, to the end that the Curious might be convinced of this matter by their own Obſervations.

Some of theſe Prædictions have been verified not only at *Rome*, and in other places of *Italy*, but alſo at *Paris* by M. *Auzout*, the moſt Celebrated and the moſt Exact of our *Aſtronomers*; and in *Holland*, by M. *Hugens*. And we can now doubt no longer, of the rotation of the *Satellits* about *Jupiter*, as the Moon turns about the Earth; nor believe, that *Jupiter* or his *Attendants* have any other Light, than that, which they receive from the Sun; as ſome did aſ-

ſure before theſe Obſervations. There remained to find by Experience, whether *Jupiter* did turn about his *Axis*, as many believe, that the *Earth* turns about her's. And although moſt *Aſtronomers* had conjectur'd, it did ſo, either by this Analogy, or by other Congruities, yet it was much wiſh'd, that we might be aſſured thereof by Obſervations. And this it is, for which we are obliged to M. *Caſſini*, who, having by the advantage of the ſame Glaſſes diſcover'd ſeveral changes, as well in the three obſcure *Belts*, commonly ſeen in *Jupiter*, as in the reſt of his *Diske*, and having alſo obſerved Spots in the midſt of that *Planet*, and ſometimes *Brightneſſes*, ſuch as have bin formerly ſeen in the *Sun*, hath at length diſcover'd a *Permanent Spot* in the *Northern* part of the moſt *Southern* Belt; by the means whereof, he hath concluded, that *Jupiter* turns about his *Axis* in 9. ~~dayes~~ *howres*, 56. minutes, and makes 29. whole circumvolutions in 12. dayes 4. minutes of ours, and 360. in 149. dayes. For he has found, that this *Spot* was not cauſed by the Shadow of any *Satellit*, as well by reaſon of its Situation, as becauſe it appeared, when there could be no Shadow. Beſides, that its motion differed from that of the Shadows, which is almoſt equal, as well towards the Edges as towards the Middle of *Jupiter*: Whereas, on the contrary, this *Spot* hath all the accidents, that muſt happen to a thing, which is upon the ſurface of a round Body moving; for example, to move much more ſlowly towards the Edges, than towards the Middle, and to paſs over that part, which is in the middle of the Diske, equal to the half of the *Diameter*, in the ſixth part of the time, it takes to make the whole revolution: he having ſeen this half paſs'd over, in 99 or 100 minutes juſt, as it muſt happen, ſuppoſing the whole circumrotation is made in 9. hours 56. minutes.

He hath not yet been able to determine the Situation of the *Axis*, upon which this motion is made, becauſe the *Belts*, according to which it is made, have for ſome years appeared ſtreight, though in the precedent years, other *Aſtronomers* have ſeen them a little crooked: Which ſheweth, that the *Axis* of the diurnal motion of *Jupiter* is a little inclined to the plain of the *Ecliptick*. But in time we may diſcover, what certainty there is in this matter.

After this excellent Diſcovery, he hath calculated many *Tables*, whereof he gives the Explication and Uſe in the Letters by him addreſſed to the Abbot *Falconieri*. By the means of them, one may know, *when* this *Spot* may be ſeen by us: For, having firſt conſidered

Theſe Tables *are not yet ſent over, but, 'tis hoped, will be, ere long.*

ſidered it in relation to the *Sun*, in reſpect whereof, its motion is regular, he conſiders the ſame in relation to the *Earth*, where *We* obſerve it; and ſhews by the means of his *Tables*, what is to be added or ſubſtracted, to know, at what time the ſaid *Spot* is to come into the middle of *Jupiter*'s Diske, according as he is Oriental or Occidental. He hath alſo conſidered it in relation to an unmovable point, which he has ſuppoſed to be the firſt point of *Aries*, becauſe we thither refer here upon Earth the beginning of all the Celeſtial motions, and *there* is the *Primum mobile*, that one would imagine, if we were in *Jupiter*, as we do here imagine Ours of 24. hours.

The Diſcovery is one of the beſt, that have been yet made in the Heavens; and thoſe, that hold the Motion of the earth, find in it a full Analogy. For, *Jupiter* turning about the Sun, does nevertheleſs turn about his *Axis*; and although he be much bigger than the Earth, he does nevertheleſs turn much more ſwiftly than it, ſince he makes more than two Turns, and a third part, for its one; and carries with him 4. Moons, as the Earth does one.

This Obſervation ought to excite all Curious perſons to endeavour the perfecting of *Optick Glaſſes*, to the end that it may be diſcovered, whether the other *Planets*, as *Mars*, *Venus* and *Mercury*, about whom no Moon hath as yet been diſcovered, do yet turn about their *Axes*, and in how much time they do ſo; eſpecially *Mars*, in whom ſome *Spot* is diſcover'd, and *Venus*, wherein M *Burattini* hath ſignified from *Poland*, he has obſerv'd Inequalities, as in the Moon.

It will be worth while, to watch for the ſeeing of *Jupiter* again this Spring, that this happy Obſervation may be confirmed in divers places, and endeavours uſed to make new ones.

An Account of ſome Books, lately publiſhed.

I. *Hydroſtatical Paradoxes, made out by New Experiments (for the moſt part Phyſical, and Eaſie) by the Honourable Robert Boyle.* This Treatiſe, promiſed in *Numb.*8. of theſe Papers, is now come forth: And was occaſioned by the peruſal of the Learned Monſieur *Paſchalls* Tract, *Of the Æquilibrium of Liquors*, and of the *Weight of the Air*: Of which two Subjects, the *latter* having been more clearly made out in *England* by Experiments, which could not be made by Monſieur *Paſchal* and others, that wanted the advantage of ſuch Engines and Inſtruments, as have here been frequently made uſe

off; Our Noble Author insists most upon giving us his thoughts of the former, *videl.* the *Æquilibrium of Liquors*: Which Discourse consisting partly of *Conclusions*, and partly of *Experiments*, the *former* seem to Him, to be almost all of them consonant to the Principles and Laws of the *Hydrostaticks*; but as for the *latter*, the Experimental proofs, offered by M. *Paschall* for his Opinions, are by our Author esteemed such, that he confesses, he hath no mind to make use of them: for which he alledges more reasons than one; which, doubtless, will appear very satisfactory to Intelligent *Readers*.

Wherefore, instead of those *Paschalian* Experiments, there is in this *Treatise* deliver'd a far more Expeditious way, to make out, *not only* most of the *Conclusions*, agreed on by these two Authors, *but* others also, that M *Paschall* mentions not; and that with so much more ease and clearness, that persons, but ordinarily versed in the common principles of *Hydrostaticks*, may readily apprehend, what is deliver'd, if they will but bring with them a due Attention, and Minds disposed to prefer Reason and Experience to Vulgar opinions and Authors.

It not being our *Authors* present Task, to deliver a Body of *Hydrostaticks*, but only some *Paradoxes*, which he conceives to be proveable by his New way of making them out, he delivers them in as many distinct Propositions; after each of which, he endeavours, in a Proof, or an Explication, to shew, both that it is true, and why it ought to be so.

The *Paradoxes* themselves (after a premised *Postulatum*) are these:

1. That in Water, and other Fluids, the Lower parts are pressed by the Upper.

2. That a lighter Fluid may gravitate or weigh upon a heavier.

3. That, if a Body, contiguous to the Water, be altogether, or in part, lower than the highest level of the said Water, the lower part of the Body will be pressed upward by the Water, that touches it beneath.

4. That in the Ascension of Water in Pumps, *&c.* there needs nothing to raise the Water, but a Competent weight of an External Fluid.

5. That the pressure of an External Fluid is able to keep an Heterogeneous Liquor suspended at the same height in several Pipes, though these Pipes be of very different Diameters.

6. If

6. If a Body be placed under Water, with its uppermoſt Surface parallel to the Horizon; how much Water ſoever there may be on this or that ſide above the Body, the direct preſſure ſuſteined by the Body (for we now conſider not the Lateral nor the Recoyling preſſure, to which the Body may be expoſed, if quite environed with Water) is no more, than that of a Column of water, having the Horizontal Superficies of the Body for its Baſis, and the Perpendicular depth of the Water for its height.

And ſo likewiſe,

If the Water, that leans upon the Body, be contained in Pipes open at both ends; the preſſure of the Water is to be eſtimated by the weight of a pillar of Water, whoſe Baſis is equal to the lower Orifice of the Pipe (which we ſuppoſe to be parallel to the Horizon) and its height equal to a perpendicular, reaching thence to the top of the Water; though the Pipe be much inclined towards the Horizon, or though it be irregularly ſhap'd, and much broader in ſome parts, than the ſaid Orifice.

7. That a Body, immerſed in a Fluid, ſuſtains a Lateral preſſure from the Fluid; and that increaſed, as the depth of the immerſed Body, beneath the Surface of the Fluid, increaſeth.

8. That Water may be made as well to depreſs a Body lighter than it ſelf, as to buoy it up.

9. That, whatever is ſaid of Poſitive Levity, a parcel of Oyl lighter than Water, may be kept in Water without aſcending in it.

10. That the cauſe of the Aſcenſion of Water in Syphons, and of its flowing through them, may be explicated without having a recourſe to Nature's abhorrency of a *Vacuum*.

11. That a Solid Body, as ponderous as any yet known, though near the Top of the water it will ſink by its own weight; yet if it be placed at a greater depth, than that of twenty times its own thickneſs; it will not ſink, if its deſcent be not aſſiſted by the weight of the incumbent Water.

Theſe are the *Paradoxes*, evinced by our Authour with much evidence and exactneſs, and very likely to invite Ingenious men to cultivate and to make further diſquiſitions in ſo excellent a part of Philoſophy, as are the *Hydroſtaticks*; an Art deſerving great *Elogiums*, not only, upon the account of its *Theorems* and *Problems*, which are moſt of them pure and handſome productions of Reaſon, very delightful and divers of them ſurpriſing, and beſides, much conducing to the clear explication and thorow-underſtand-

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ing of many both familiar and abſtruſe *Phænomena* of Nature; but alſo, upon the ſcore of its *Practical* uſe, ſince the Propoſitions, it teaches, may be of great importance to Navigation, and to thoſe that inquire into the Magnitudes and Gravities of Bodies, as alſo to them, that deal in Salt-works: Beſides, that the *Hydroſtaticks* may be made divers waies ſerviceable to *Chymiſts*, as the Author intimates, and intends to make manifeſt, upon ſeveral occaſions, in his yet unpubliſht part of the *Uſefulneſs of Natural and Experimental Philoſophy*.

Theſe Propoſitions are ſhut up by two important *Appendixes*, whereof the *one* contains an Anſwer to ſeven Objections by a late learned Writer, to evince, that the upper parts of water preſs not upon the lower; the *other*, ſolves that difficult *problem*, why *Urinators* or *Divers*, and others, who deſcend to the bottom of the Sea, are not oppreſſed with the weight of the incumbent water? where, among other ſolutions, *that* is examined, which occurs in a printed Letter of Monſieur *des Cartes*, but is found unſatisfactory.

II. *Nicolai Stenonis de Muſculis & Glandulis Obſervationum ſpecimen cum duabus Epiſtolis Anatomicis*. In the *ſpecimen* it ſelf, the Author, having deſcribed in *general*, both the *Structure* and the *Function* of the *Muſcles*, applies that deſcription to the *Heart*, to demonſtrate that *that* is alſo a *true Muſcle*: Obſerving *firſt*, that in the ſubſtance of the *Heart* there appears nothing but *Arteries*, *Veins*, *Nerves*, *Fibres*, *Membrans*; and that that, & nothing elſe is found in a *Muſcle*; affirming withall, that which is commonly taught of the *Muſcles*, and particularly of the *Heart's Parenchyma*, as diſtinct from *Fibres*, is due, not to the *Senſes*, but the *Wit* of *Anatomiſts*: ſo that he will not have the *Heart* made up of a ſubſtance peculiar to it ſelf, nor conſidered as the principle of *Innate heat*, or of *Sanguification*, or of *vital ſpirits*. He obſerves *next*, that the *Heart* performs the like *operation* with the *Muſcles*, to wit, to contract the Fleſh; which action how it can have a different cauſe from that of the Contraction made in the *Muſcles*, where there is ſo great a parity and agreement in the *Veſſels*, he ſees not. And as for the *Phænomena*, that occur, of the *Motion* of the Heart, he undertakes to explicate them all, from the *Ductus* or *Poſition* of the *Fibres*; but refers for the performance of this undertaking to another *Treatiſe*, he intends to publiſh.

As to his Obſervations abous *Glanduls*, he affirms, that he has been the Firſt, that has diſcover'd that Veſſel, which by him is call'd *Salivare*,

Salivare Exterius, passing from the *Parotides* (or the two chief Arteries that are on the right and left side neer the Throat) into the Mouth, and conveying the *Spittle*: Where he also gives an account of several other Vessels and Glanduls, some about the *Lips*; others under the *Tongue*; others in the *Pallate* &c. To which he adds the Vessels of the *Eye-lids*, which have their root in the *Glanduls* that are about the Eyes, and serve for the *shedding of Tears*. He mentions also several things about the *Lymphatick vessels*, and is of opinion, that the knowledge thereof may be much illustrated by that kind of *Glanduls* that are called *Conglobatæ*, and by their *true* insertion into the veins; the mistake of the latter whereof, he conceives to have very much misled the Noble *Ludovicus de Bills*, notwithstanding his excellent method of *dissection*. And here he observes *first*, that all the *Lymphatick vessels* have such a commerce with the *Glanduls*, that none of them is found in the body, which either has not its origine *from*, or is inserted *into* a *Glandule*: And *then*, that *Glanduls* are a kind of *Strainers*, so form'd, that whilst the Blood passes out of the Arteries into the Veins through the small *Capillary* vessels, the *Serous* parts thereof, being freed from the *Sanguineous*, are by vertue of the heat expell'd through fit pores into the *Capilaries* of the *Lymphaticks*; the direction of the *Nerves* concurring.

Conglobate *Glanduls are called those, that do consist, as it were, of one continued substance, having an* even *superficies*; *whereof there are many in the* Mesentery, *and in other places: contra distinguisht to those, that bear the name of* Conglomerate *Glanduls, which are made up of several small Kernels, such as the* Pancreas, *the* Salivating Glanduls, *&c.*

Of the two annex'd *Epistles*, the *First* gives an account of the dissection of two *Raja's* or *Skates*, and relates that the Author found in the bellies of these Fishes a *Haddock* of $1\frac{1}{2}$ span long, and a *Sole*, a *Plaise*, and nine middle-sized *Sea-crafishes*; whereof not only the three former had their flesh, in the fishes stomack, turn'd into a *fluid*, and the Gristles or Bones into a *soft* substance, but the *Crafishes* had their shels comminuted into very small particles, tinging here and there the *Chyle* near the *Pylorus*; which he judges to be done not so much by the heat of the Fishes stomack, as by the help of some digesting juyce. Coming to the *Uterus* of these Fishes, he takes occasion to examine, with what ground several famous *Naturalists* and *Anatomists* have affirm'd, that Eggs are the *uterus* exposed or ejected out of the body of the Animal. Taking a view of their *Heart*, he there finds but *one* ventricle, and discourses of the difficulty arising from thence. As for the *Lungs*, he saw no clearer footsteps of them in these, than he had done in other Fishes: but within the mouth he trac'd several *gaping fissures*, and found the receses of the *Gills* so form'd, that the water taken in at the mouth, being let out by these dores, cannot by them re-enter, by reason of a skin, outwardly passing over every hole, and covering it. Where he intimates, that though Fishes have not *true* Lungs, yet they want not a *Succedaneum* thereto; to wit, the *Gills*; and if *water* may be to Fishes, what *Air* is to terrestrial Animals, for Respiration: asserting, that whereas nothing is so necessary for the conservation of Animal life, as a reciprocal Access and Recess of the *Ambient* to the sanguineous vessels, tis all one, whether that be done by receiving the Ambient *within* the body, or by its gentle passing *by* the *Prominent* vessels of the *Gills*.

The other *Epistle*, contains some Ingenious Observations, touching the way, by which the Chicken, yet in the shell, is nourish't, *videl.* not by the conveyance of the *Yolk* into the *Liver* by the *Umbilical* vessels, nor into the *Stomack* by the

Mouth,

Mouth, but by a Peculiar *ductus*, by him deſcribed, into the *Inteſtins*, where, according to his alledged experience, it is turn'd into *Chyle*: which he affirms, he hath diſcover'd, by taking an Egge from under a brooding Hen, when the Chicken was ready to break forth, and when he was looking for the paſſage of the *Yolk*, out of its integument into the *Liver*, by finding *it* paſs thence into the *Inteſtins*, as he found the *White* to do by the *mouth* into the *belly*. Whence he inclines to infer, that, ſince every *fœtus* takes in at the mouth the liquor it ſwims in, and ſince the Chicken receives the *white* of the Egge into the *mouth*, and the *yolk* by the new diſcover'd *ductus* into the *Inteſtins*, it cannot be certainly made out, that a *part* of the *Chyle* is conveyed into the *Liver*, before it paſſes into the *Heart*: Exhorting in the mean time the *Patrons* of the *Liver*, that they would produce Experiments to evince their Ratiocinations.

III. *Regneri de Graeff, de Succi Pancreatici Natura & uſu, Exercitatio Anatomico-medica.* In this Tract, the Induſtrious Author, after he has enumerated the various opinions of *Anatomiſts* concerning the uſe of that kernelly ſubſtance, call'd *Pancreas* (in *Engliſh*, the *Sweetbred*) endeavours to prove experimentally that this *Glandule* was not form'd by Nature, to ſeparate any *Excrementitious* humor, and to convey it into the *Inteſtins*, but to prepare an *uſeful* juyce out of the Blood and Animal ſpirits, of a ſomewhat *Acid* taſte, and to carry the ſame into the Gut, call'd *Duodenum*, to be there mixt with the Aliment, that has been in ſome degree already fermented in the Stomack, for a further fermentation, to be produced by the conflux of the ſaid acid *Pancreatick* juyce and ſome *Bilious* matter, abounding with volatile Salt, cauſing an Effervеſcence; which done, that juyce is, together with the purer part of the nouriſhment, carried into the *Milkie* veins, thence into the *common receptacle* of the *Chyle* and *Lymphatick liquor*, and ſo through the *ductus Thoracicus* into the right Ventricle of the Heart.

This Aſſertion, firſt advanced (ſaith the *Author*) partly by *Gothofredus Mebius*, partly by *Franciſcus de le Boe Sylvius*, he undertakes to prove by experiments; which, indeed, he has with much induſtry, tried upon ſeveral Animals, to the end that he might collect ſome of this juyce of the *Pancreas* for a taſte: which having at laſt obtained, and found it ſomewhat *acid*, he thereupon proceeds to deliver his opinion both of the *conſtitution* and quantity of this *Succus* in *healthy* Animals, and the vices thereof, in the *unhealthy*: deriving moſt diſeaſes *partly* from its too great Acidity, or from its ſaltneſs, or harſhneſs; *partly* from its paucity or redundancy: but eſpecially, endeavouring to reduce from thence, as all *intermittent Feavers* (of all the *Phænomena* whereof he ventures to aſſign the cauſes from this *Hypotheſis*) ſo alſo the *Gout*, *Syncope's*, *Stranguries*, *Oppilations*, *Diarrhœas*, *Dyſenteries*, *Hyſterical* and *Colick paſſions*, &c. All which he concludes with mentioning the waies and remedies to cure the manifold peccancy of this juyce by Evacuations and Alterations.

This ſeeming to be a *new* as well as a *conſiderable* diſcovery, it is hop'd, that others will by this intimation be invited to proſecute the ſame by further experiments, either to confirm what this Author has ſtarted, if true, or to rectifie it, if he be miſtaken.

NOTE.

In *Fig.* 1. of *Num.* 9. of theſe Tracts, the Graver hath placed the bended *end* of the *ſpringing Wire* C F, above the *Wire-ſtaple* B, between it and the *Ring E*, of the *Weight* D; whereas *that* end ſhould have been ſo expreſſed, as to paſs *under* the *Wire-ſtaple*, betwixt its two Wires, into the ſaid *Ring*.

London, Printed for *John Martyn*, and *James Alleſtry*, Printers to the Royal Society. 1666.

PHILOSOPHICAL TRANSACTIONS.

Munday, April 2. 1666.

The Contents.

A Confirmation of the former Account, touching the late Earthquake *near* Oxford, *and the Concomitants thereof, by Mr.* Boyle. *Some Obſervations and Directions about the* Barometer, *communicated by the ſame Hand. General Heads for a* Natural Hiſtory *of a Country, ſmall or great, propoſed by the ſame. An Extract of a Letter, written from* Holland, *about* Preſerving Ships from being Worm-eaten. *An Account of Mr.* Boyle's *lately publiſh't Tract, entituled,* The Origine of Forms and Qualities, *illuſtrated by Conſiderations and Experiments.*

A Confirmation of the former Account touching the late Earthquake *near* Oxford, *and the Concomitants thereof.*

THis Confirmation came from the Noble Mr *Boyle* in a Letter, to the *Publiſher*, as followeth:

As to the *Earth-quake*, your curioſity about it makes me ſorry, that, though I think, I was the firſt, that gave notice of it to ſeveral of the *Virtuoſi* at *Oxford*; yet the Account, that I can ſend you about it, is not ſo much of the *Thing* it ſelf,

as of the *Changes of the Air*, that accompanied it. To inform you of which, I muſt relate to you, that riding one Evening ſomewhat late betwixt *Oxford* & a Lodging, I have at a place, 4. miles diſtant from it, the weather having been for a pretty while Froſty, I found the Wind ſo very cold, that it reduced me to put on ſome defenſives againſt it, which I never ſince, nor, if I forget not, all the foregoing part of the Winter was obliged to make uſe off. My unwillingneſs to ſtay long in ſo troubleſome a Cold, which continued very piercing, till I had got half way home-ward, did put me upon galloping at no very laſy rate; and yet, before I could get to my Lodgings, I found the Wind turned, and felt the Rain falling; which, conſidering the ſhortneſs of the time, and that this Accident was preceded by a ſetled Froſt, was ſurpriſing to me, and induced me to mention it at my return, as one of the greateſt and ſuddaineſt Alterations of Air, I had ever obſerv'd: And what changes I found, have been taken notice of in the *Gravity* of the *Atmoſphere* at the ſame time by that Accurate Obſerver * Dr. *Wallis*, who then ſuſpected nothing of what follow'd; as I ſuppoſe, he has ere this told you himſelf. Soon after, by my gueſs about an hour, there was a manifeſt *Trembling* in the Houſe where I was (which ſtands high in compariſon of *Oxford*.) But it was not there ſo great, but that I, who chanced to have my thoughts buſied enough on other matters, than the weather, ſhould not have taken notice of it as an *Earth-quake*, but have imputed it to ſome other cauſe, if one, that you know, whoſe hand is employed in this Paper, and begins to be a diligent obſerver of Natural things, had not advertis'd me of it; as being taken notice of by him and the reſt of the people of the Houſe. And ſoon after there hapned a briſk Storm: whereupon I ſent to make inquiry at a place call'd *Brill*, which ſtanding upon a much higher ground, I ſuppoſed might be more obnoxious to the effects of the *Earth-quake* (of which, had I had any ſuſpition of it, my having formerly been in one neer the *Lacus Lemanus*, would have made me the more obſervant:) But the perſon I ſent to, being diſabled

* *See* Num. 10. Phil. Tranſactions *p.* 166 -- 171; *at the time of the printing whereof, this Relation of Mr.* Boyle *was not yet come to hand.*

diſabled by ſickneſs to come over to me (which he promis'd to do, as ſoon as he could) writ me only a *Ticket*, whoſe ſubſtance was, That the *Earth-quake* was there much more conſiderable, than where I lodged, and that at a Gentlemans houſe, whom he names (the moſt noted Perſon, it ſeems, of the neighbourhood) the Houſe trembled very much, ſo as to make the Stones manifeſtly to move to and fro in the Parlour, to the great amazement and fright of all the Family. The Hill, whereon this *Brill* ſtands, I have obſerv'd to be very well ſtor'd with Mineral ſubſtances of ſeveral kinds; and from thence I have been inform'd by others, that this Earth-quake reach'd a good many miles; but I have neither leaſure, nor inclination to entertain you with uncertain reports of the Extent and other Circumſtances, eſpecially ſince a little further time an inquiry may enable me to give you a better warranted account.

Some Obſervations and Directions about the Barometer, *communicated by the ſame Hand, to the* Author *of this* Tract.

Theſe ſhall be ſet down, as they came to hand in another Letter; *videl.*

As to the *Barometrical* Obſervations (as for brevities ſake I uſe to call them) though you * gueſſed aright, that, when I ſaw thoſe of the Learned and Inquiſitive Dr. *Beale*, I had not Mine by me, (for I left them, ſome years ſince, in the hands of a *Virtuoſo*, nor have I now the leaſure to look after thoſe Papers;) yet ſince by the Communication, you have made publick, 'tis probable, that divers Ingenious men will be invited to attempt the like Obſervations, I ſhall (notwithſtanding my preſent haſte) mention to you ſome particulars, which perhaps will not appear unſeaſonable, that came into my mind upon the reading of what you have preſented the Curious.

* *See* Num. 9. *of the* Phil. Tranſact. *p.* 159. *the laſt* paragraph.

When I did, as you may remember, ſome years agoe, publickly expreſs and deſire that ſome Inquiſitive men would

make *Baroſcopical* Obſervations in ſeveral parts of *England* (if not in forrain Countries * alſo;) and to aſſiſt them, to do ſo, preſented ſome of my Friends with the neceſſary Inſtruments: The declared reaſon of my deſiring this Correſpondence was (among other things) that by comparing Notes, *the Extent of the Atmoſpherical Changes, in point of Weight, might be the better eſtimated.* But not having hitherto received ſome account, that I hoped for, I ſhall now, without ſtaying for them, intimate thus much to you: That it will be very convenient, that the Obſervers take notice not only of the *day*, but, as near as they can, of the *Houre* wherein the height of the *Mercurial Cylinder* is obſerv'd: For I have often found, that within leſs than the compaſs of one day, or perhaps half a day, the Altitude of it has ſo conſiderably vary'd, as to make it in many caſes difficult, to conclude any thing certainly from Obſervations, that agree but in the day.

* *Some whereof have been ſince invited by the* Publiſher, *to give their concurrence herein.*

It will be requiſite alſo, that the Obſervers give notice of the *Scituation of the place*, where their *Barometers* ſtand, not only, becauſe it will aſſiſt men to Judge, whether the Inſtruments were duely perfected, but principally, becauſe, that though the *Baroſcope* be good (nay, becauſe it is ſo) the Obſervations will much diſagree, even when the *Atmoſphere* is in the ſame ſtate, as to Weight, if one of the Inſtruments ſtand in a conſiderably higher part of the Countrey, than the other.

To confirm *both* the foregoing admonitions, I muſt now inform you, that, having in theſe parts two Lodgings, the one at *Oxford*, which you know ſtands in a bottom by the *Thames* ſide, and the other at a place, four miles thence, ſeated upon a moderate *Hill*, I found, by comparing two *Baroſcopes*, that I made, the one at *Oxford*, the other at *Stanton St. Johns*, that, though the former be very good, and have been noted for ſuch, during ſome years, and the latter was very carefully fill'd; yet by reaſon, that in the *Higher* place, the incumbent part of the *Atmoſphere* muſt be lighter, than in the *Lower*, there is almoſt always

ways between 2 and 3 Eights of an Inch difference betwixt them: And having ſometimes order'd my ſervants to take notice of the Diſparity, and divers times carefully obſerv'd it my ſelf, when I paſs'd to and fro between *Oxford* and *Stanton*, I generally found, that the *Oxford Barometer* and the *other*, did, as it were by common conſent, riſe and fall together ſo, as that in the former the *Mercury* was uſually ⅜ higher, than in the latter.

Which Obſervations may teach us, that the Subterraneous ſteams, which aſcend into the Air, or the other Cauſes of the varying Weight of the *Atmoſphere*, do, many times, and at leaſt in ſome places, uniformly enough affect the Air to a greater height, than, till I had made this tryall, I durſt conclude.

But, as moſt of the *Barometricall* obſervations are ſubject to exception, ſo I found the formerly mentioned to be. For (to omit leſſer variations) riding one Evening from *Oxford* to *Stanton*, and having, before I took horſe, look't on the *Baroſcope* in the former of theſe 2. places, I was ſomewhat ſurpriſed, to find at my comming to the latter, that in places no farther diſtant, and notwithſtanding the ſhortneſs of the time (which was but an hour and a half, if ſo much) the *Barometer* at *Stanton* was ſhort of its uſual diſtance from the *other*, near a quarter of an *Inch*, though, the weather being fair and calm, there appear'd nothing of manifeſt change in the Air, to which I could adſcribe ſo great a Variation; and though alſo, ſince that time, the *Mercury* in the two Inſtruments hath, for the moſt part, proceeded to riſe and fall as before.

And theſe being the only Obſervations, I have yet met with, wherein *Baroſcopes*, at ſome *Diſtance of Place*, and *Difference of Height*, have been compar'd (though I cannot now ſend you the Reflexions, I have elſewhere made upon them;) as the opportunity I had to make them my ſelf, rendred them not unpleaſant to me, ſo perhaps the Novelty will keep them from being unwelcome to you. And I confeſs, I have had ſome flying ſuſpicions, that the odd *Phænomena* of the *Baroſcope*, which have hitherto more poſ'd, than inſtructed us, may in time, if a

com-

competent number of Correſpondents do diligently proſecute the Inquiries (eſpecially with *Baroſcopes*, accommodated with Mr. *Hooks* ingenious additions) make men ſome *Luciferous* diſcoveries, that poſſibly we do not yet dream off.

I know not, whether it will be worth while to add, that ſince I was oblig'd to leave *London*, I have been put upon ſo many leſſer removes, that I have not been able to make *Baroſcopical* Obſervations with ſuch a conſtancy, as I have wiſhed, but, as far as I remember, the *Quick-ſilver* has been for the moſt part, ſo high, as to invite me to take notice of it; and to deſire you to do me the favour to inquire among your correſpondents whether they have obſerv'd the ſame thing. * For, if they have, this laſting (though not uninterrupted) Altitude of the *Quick-ſilver*, happening, when the Seaſons of the year have been extraordinary dry (ſo much as to become a grievance, and to dry up, as one of the late *Gazettes* informs us, ſome ſprings near *Waymouth*, that uſed to run conſtantly) it may be worth inquiry, whether theſe obſtinate Droughts, may not by cleaving of the ground too deep, and making it alſo in ſome places more porous and as it were, ſpungy, give a more copious Vent, than is uſual, to ſubterraneal ſteams, which adſcending into the Air, increaſe the gravity of it. The inducements I have to propoſe this inquiry, I muſt not now ſtay to mention. But perhaps, if the Obſervation holds, it may prove not uſeleſs in reference to ſome Diſeaſes.

* *This hath been inquired into, and is found, that ſeveral Accurate and Curious perſons* (*as the Moſt Noble* Preſident of the Royal Society, *the Lord Viſcount* Brounker, Doctor Beale, Mr. Hook &c.) *have obſerved the ſame.*

Perhaps it will be needleſs to put you in mind of directing thoſe *Virtuoſi*, that may deſire your Inſtructions about *Baroſcopes*, to ſet down in their Diarys not only the day of the month, and the hour of the day, when the *Mercuries* height is taken, but (in a diſtinct *Columne*) the weather, eſpecially the Winds, both as to the Quarters, whence they blow (though that be not always ſo eaſy nor neceſſary,) and as to the Violence or Remiſneſs, wherewith they blow. For, though it be more difficult,

than

than one would think, to ſettle any general rule about the riſing and falling of the *Quick-ſilver*; yet in theſe parts one of thoſe, that ſeem to hold oftneſt, is, * that when high winds blow, the *Mercury* is the lower; and yet that it ſelf does ſometimes fail: For, this very day (*March* 3.) though on that hill, where I am, the ſomewhat Weſterly Winds have been bluſtering enough, yet ever ſince morning the *Quick-ſilver* has been riſing, and is now riſen near $\frac{1}{8}$ of an *Inch*.

* *See Number* 9. Phil. Tranſact. *p.* 157. §. 8. *&* 9. *where the Word*, Generally, *ſignifies no more, than* for the moſt part.

I had thoughts to add ſomething about another kind of *Baroſcope* (but inferiour to that in uſe) whereof I have given ſome intimation in one of the *Præliminaries* to the *Hiſtory of Cold*. But you have already too much of a letter, and my occaſions, *&c.*

So far that Letter. Since which time, another from the ſame Noble Obſerver intimates, That, as for that cauſe of the height of the *Quick-ſilver* in Droughts, which by him is ſuſpected to be the elevation of ſteams from the *Cruſt* or Superficial parts of the Earth, which by little and little may add to the Weight of the *Atmoſphere*, being not, as in other ſeaſons, carried down from time to time by the falling Rain, it agrees not ill with what he has had ſince occaſion to obſerve. For, whereas about *March* 12th, at *Oxford*, the *Quick-ſilver* was higher, than, for ought he knew, had been yet obſerv'd in *England*, viz. above $\frac{1}{16}$ above 30. *Inches*, upon the firſt conſiderable ſhowers, that have interrupted our long Drought, as he affirms, he foretold divers hours before that the *Quick-ſilver* would be very low, (a bluſtering Wind concurring with the Rain) ſo he found it at *Stanton* to fall $\frac{3}{8}$ beneath 29. *Inches*. *

* *Dr.* Beale *concurs with this Obſervation, when he ſaith, in a late* Letter *of* March 19. *to his Correſpondent in* London; By change of Weather and Wind, the *Mercury* is ſunk more than an *Inch*, ſince I wrote to you on *Munday* laſt, *March* 12. This laſt night, by Rain and South-wind, 'tis ſunk *half an Inch*.

General

General Heads for a Natural Hiſtory of a Countrey, *Great or ſmall, imparted likewiſe by Mr.* Boyle.

It having been already intimated (*Num.*8. *of Phil. Tranſact.* p. 140. 141.) that divers *Philoſophers* aime, among other things, at the Compoſing of a good Natural Hiſtory, to ſuperſtruct, in time, a *Solid* and *Uſeful* Philoſophy upon ; and it being of no ſlight importance, to be furniſht with pertinent Heads, for the direction of Inquirers; that lately named *Benefactour to Experimental Philoſophy*, has been pleaſed to communicate, for the ends aboveſaid, the following *Articles*, which (as himſelf did ſignifie) belong to one of his *Eſſays* of the unpubliſht part of the *Uſefulneſs of Nat. and Experimen. Philoſophy*.

But firſt he premiſes, that what follows, is deſign'd only to point at the more *General* heads of Inquiry, which the propoſer ignores not to be Divers of them very comprehenſive, in ſo much, that about ſome of the *Subordinate* ſubjects, perhaps too, not the moſt fertile, he has drawn up *Articles* of inquiſition about particulars, that take up near as much room, as what is here to be deliver'd of this matter.

The *Heads* themſelves follow;

The things, to be obſerv'd in ſuch a Hiſtory, may be variouſly (and almoſt at pleaſure) divided: As, into *Supraterraneous*, *Terreſtrial*, and *Subterraneous*; and otherwiſe: but we will at preſent diſtinguiſh them into thoſe things, that reſpect the *Heavens*, or concern the *Air*, the *Water*, or the *Earth*.

1. To the *Firſt* ſort of Particulars, belong the Longitude and Latitude of the Place (that being of moment in reference to the obſervations about the Air *&c.*) and conſequently the length of the longeſt and ſhorteſt days and nights, the Climate, parallels *&c.* what fixt ſtarrs are and what not ſeen there: What Conſtellations 'tis ſaid to be ſubject to? Whereunto may be added other Aſtrological matters, if they be thought worth mentioning.

2. About

2. About the *Air* may be obſerv'd, its Temperature, as to the firſt four Qualities (commonly ſo call'd) and the Meaſures of them: its Weight, Clearneſs, Refractive power: its Sublety or Groſsneſs: its abounding with, or wanting an *Eſurine* Salt: its variations according to the ſeaſons of the year, and the times of the day; What duration the ſeveral kinds of VVeather uſually have: VVhat *Meteors* it is moſt or leaſt wont to breed; and in what order they are generated; and how long they uſually laſt: Eſpecially, what Winds it is ſubject to; whether any of them be ſtated and ordinary, *&c.* What diſeaſes are Epidemical, that are ſuppoſed to flow from the Air: What other diſeaſes, wherein *that* hath a ſhare, the Countrey is ſubject to; the Plague and Contagious ſickneſſes: What is the uſual ſalubrity or inſalubrity of the Air; and with what Conſtitutions it agrees better or worſe, than others.

3. About the *Water*, may be obſerv'd, the Sea, its Depth, degree of Saltneſs, Tydes, Currents, *&c.* *Next*, Rivers, their Bigneſs Length, Courſe, Inundations, Goodneſs, Levity (or their Contraries) of Waters, *&c.* *Then*, Lakes, Ponds, Springs, and eſpecially Mineral waters, their Kinds, Qualities, Vertues, and how examined. To the *Waters* belong alſo *Fiſhes*, what kinds of them (whether Salt or Freſh-water fiſh) are to be found in the Country; their Store, Bigneſs, Goodneſs, Seaſons, Haunts, Peculiarities of any kind, and the wayes of taking them, eſpecially thoſe that are not purely *Mechanical*.

4. In the *Earth*, may be obſerved,

1. *It ſelf.*
2. Its *Inhabitants*, and its *Productions*, and theſe *External*, and *Internal*.

Firſt, in the Earth *it ſelf*, may be obſerv'd, its dimenſions, ſcituation, Eaſt, Weſt, North, and South: its Figure, its Plains, and Valleys, and their Extent; its Hills and Mountains, and the height of the talleſt, both in reference to the neighbouring Valleys or Plains, and in reference to the Level of the Sea: As

alſo, whether the Mountains lye ſcattered, or in ridges, and whether thoſe run North and South, or Eaſt and Weſt, *&c.* What Promontories, fiery or ſmoaking Hills, *&c.* the Country has, or hath not: Whether the Country be coherent, or much broken into Ilands. What the Magnetical Declination is in ſeveral places, and the Variations of that Declination in the ſame place (and, if either of thoſe be very conſiderable, then, what circumſtances may aſſiſt one to gueſs at the Reaſon as Subterraneal fires, the Vicinity of Iron-mines, *&c.*) what the Nature of the Soyle is, whether Clays, Sandy, *&c.* or good Mould; and what Grains, Fruits, and other Vegetables, do the moſt naturally agree with it: As alſo, by what particular Arts and Induſtries the Inhabitants improve the Advantages, and remedy the Inconveniences of their Soyl: What hidden qualities the Soyl may have (as that of *Ireland*, againſt Venomous Beaſts, *&c.*)

Secondly, above the ignobler *Productions* of the Earth, there muſt be a careful account given of the *Inhabitants* themſelves, both *Natives* and *Strangers*, that have been long ſettled there: And in particular, their Stature, Shape, Colour, Features, Strength, Agility, Beauty (or the want of it) Complexions, Hair, Dyet, Inclinations, and Cuſtoms that ſeem not due to Education. As to their Women (beſides the other things) may be obſerved their Fruitfulneſs or Barrenneſs; their hard or eaſy Labour, *&c.* And both in Women and Men muſt be taken notice of what diſeaſes they are ſubject to, and in theſe whether there be any ſymptome, or any other Circumſtance, that is unuſual and remarkable.

As to the *External* Productions of the Earth, the Inquiries may be ſuch as theſe: What Graſſes, Grains, Herbs, (Garden and Wild) Flowers, Fruit-trees, Timber-trees (eſpecially any Trees, whoſe wood is conſiderable) Coppices, Groves, Woods, Forreſts, *&c.* the Country has or wants: What peculiarities are obſervable in any of them: What Soyles they moſt like or diſlike; and with what Culture they thrive beſt. What *Animals* the Country has or wants, both as to wild Beaſts, Hawks, and other Birds of Prey; and as to Poultrey, and Cattle

Cattle of all ſorts, and particularly, whether it have any *Animals*, that are not common, or any thing, that is peculiar in thoſe, that are ſo.

The *Internal* Productions or Concealments of the Earth are here underſtood to be, the riches that ly hid under the Ground, and are not already referr'd to other Inquiries.

Among theſe *Subterraneal* obſervations may be taken notice of, what ſorts of Minerals of any kind they want, as well as what they have: *Then*, what Quarries the Country affords, and the particular conditions both of the Quarries and the Stones: As alſo, how the Beds of Stone lye, in reference to North and South, *&c.* What Clays and Earths it affords, as Tobacco-pipe-clay, Marles, Fullers-earths, Earths for Potters wares, Bolus's and other medicated Earths: What other Minerals it yields, as Coals, Salt-Mines, or Salt-ſprings, Allom, Vitrial, Sulphur, *&c.* What Mettals the Country yields, and a deſcription of the Mines, their number, ſcituation, depth, ſigns, waters, damps, quantities of ore, goodneſs of ore, extraneous things and ways of reducing their ores into Mettals, *&c.*

To theſe General Articles of inquiries (ſaith their *Propoſer*) ſhould be added; 1 *Inquiries* about *Traditions* concerning all particular things, relating to that Country, as either peculiar to it, or at leaſt, uncommon elſewhere. 2 *Inquiries*, that require *Learning* or *Skill* in the Anſwerer: to which ſhould be ſubjoyned *Propoſals* of ways, to enable men to give Anſwers to theſe more difficult inquiries.

Thus far our Author, who, as he has been pleaſed to impart theſe *General* (but yet very *Comprehenſive* and greatly *Directive*) Articles; ſo, 'tis hoped from his own late intimation, that he will ſhortly enlarge them with *Particular* and *Subordinate* ones. Theſe, in the mean time, were thought fit to be publiſht, that the Inquiſitive and Curious, might, by ſuch an Aſſiſtance, be invited not to delay their ſearches of matters, that are ſo highly conducive to the improvement of *True Philoſophy*, and the welfare of *Mankind*.

An Extract
Of a Letter, Written from Holland, *about* Preſerving of Ships from being Worm-eaten.

This *Extract* is borrowed from the *French journal des Scavans* of *Febr.* 15. 1666. and is here inſerted, to excite Inventive heads *here*, to overtake the Propoſer in *Holland*. The letter runs thus:

Although you have viſited our Port (*Amſterdam*) I know not whether you have noted the ill condition, our ſhips are in, that return from the *Indies*. There is in thoſe Seas a kind of ſmall worms, that faſten themſelves to the Timber of the ſhips, and ſo pierce them, that they take water every where; or if they do not altogether pierce them thorow, they ſo weaken the wood, that it is almoſt impoſſible to repair them. We have at preſent a Man here, that pretends to have found an admirable ſecret to remedy this evil. That, which would render this ſecret the more important, is, that hitherto very many ways have been uſed to effect it, but without ſucceſs. Some have imployed Deal, Hair and Lime, &c. and therewith lined their ſhips; but, beſides that this does not altogether affright the worms, it retards much the ſhips Courſe. The *Portugals* ſcorch their ſhips, inſomuch that in the quick works there is made a coaly cruſt of about an *Inch* thick. But as this is dangerous, it happening not ſeldom, that the whole veſſel is burnt; ſo the reaſon why worms eat not thorow *Portugal* ſhips, is conceived to be the exceeding hardneſs of the Timber, employed by them.

We expect with impatience the nature and effect of this Propoſition. Many have already ventur'd to give their thoughts concerning it. Some ſay, there needs no more, but to build Ships of a harder kind of Wood, than the uſual. Others having obſerved, that theſe Worms faſten not to a kind of wild *Indian* Pear-tree, which is highly bitter, do thereupon ſuggeſt,

geſt, that the beſt Expedient would be, to find out a Wood having that quality. But certainly there being now no Timber, fit for Ships, that is not known, 'tis not likely that any will be found either more hard, or more bitter, than that, which has been hitherto employed. Some do imagine, that the Propoſer will, by certain *Lixiviums*, give to the ordinary Wood ſuch a quality and bitterneſs, as is found in the already mention'd *Indian* Pear-tree. But this alſo will hardly ſucceed, ſince it will be requiſite not only to make *Lixiviums*, in great quantities at an eaſie rate, and ſtrong enough to penetrate the thick ſides of a Ship, but alſo to make them durable enough, not to be waſh't out by the Sea. Yet notwithſtanding, in theſe matters one ought to ſuſpend on's judgement, untill experience do ſhew, what is to be believed of them.

So far the Extract. To which it may perhaps not be unſeaſonable to add, that a very worthy perſon in *London*, ſuggeſts the Pitch, drawn out of Sea coles, for a good Remedy to ſcare away theſe noyſome inſects.

An Account

Of a Book, very lately publiſh't, entituled, The Origine of Forms and Qualities, *illuſtrated by Conſiderations and Experiments, by the Honourable* Robert Boyle.

This Curious and Excellent Piece, is a kind of *Introduction* to the *Principles* of the *Mechanical Philoſophy*, explicating, by very Conſiderable Obſervations and Experiments, what may be, according to ſuch Principles, conceived of the *Nature and Origine of Qualities and Forms*; the knowledge whereof, either makes or ſuppoſes the Fundamental and Uſeful part of *Natural Philoſophy.* In doing of which, the Author, to have his way the clearer, writes rather for the *Corpuſcularian* Philoſophers (as he is pleaſed to call them) in *General*, than any

Party

Party of them, keeping himſelf thereby diſengaged from adopting an *Hypotheſis*, in which perhaps he is not ſo throughly ſatisfied, and of which he does not conceive himſelf to be neceſſitated to make uſe here; and accordingly forbearing to employ Arguments, that are either grounded on, *or* ſuppoſe *Atoms*, *or* any *Innate Motion* belonging to them; *or* that the Eſſence of Bodies conſiſts in Extenſion; *or* that a *Vacuum* is impoſſible; *or* that there are ſuch *Globuli Cæleſtes*, *or* ſuch a *Materia Subtilis*, as the *Carteſians* imploy to explicate moſt of the *Phænomena* of Nature.

The *Treatiſe* conſiſting of *a Speculative*, and an *Hiſtorical* part, the Author, with great modeſty leaves the *Reader* to judge; *Whether* in the *Firſt* part he hath treated of the *Nature* and *Origine of Forms and Qualities* in a more Comprehenſive way, than others; *Whether* he has by fit Examples, and other means, rendred it more intelligible, than they have done: *Whether* he has added any conſiderable number of Notions and Arguments towards the compleating and confirming of the propoſed *Hypotheſis*: *Whether* he has with reaſon diſmiſſed Arguments unfit to be relied on; and *Whether* he has propoſed ſome Notions and Arguments ſo warily, as to keep them from being liable to Exceptions and Evaſions, whereto they were obnoxious, as others have propoſed them. And, as to the *Second* and *Hiſtorical* part, he is enclin'd to believe, that the *Reader* will grant, he hath done that part of *Phyſicks*, he is treating of, ſome ſervice, by ſtrengthning the doctrines of the *New Philoſophy* (as 'tis call'd) by ſuch particular Experiments, whoſe Nature and Novelty will render them as well Acceptable as Inſtructive.

The *ſumme* of the *Hypotheſis*, fully and clearly explicated in the *Firſt* Part, is this;

That all Bodies are made of *one Catholick matter*, common to them all, and differ but in *Shape*, *Size*, *Motion* or *Reſt*, and *Texture* of the ſmall parts, they conſiſt off; from which Affections

ctions of Matter, the *Qualites*, that difference particular Bodies, reſult: whence it may be rationally concluded, that one kind of Bodies may be tranſmuted into another; *that* being in effect no more, than that one Parcel of the Univerſal Matter, wherein all Bodies agree, may have a *Texture* produced in it, like the *Texture* of ſome other Parcel of Matter, common to them both.

To this *Hypotheſis*, is ſubjoin'd an Examination of the *Scholaſtick* opinion of *Subſtantial Forms*; where the Author, *Firſt*, States the Controverſie; *next*, gives the Principal reaſons, that move him to oppoſe that Opinion; *then*, anſwers the Main arguments employed to evince it; *further*, aſſigns both the *Firſt* Cauſe of Forms (*God*;) and the Grand *Second* Cauſe thereof (*Local Motion:*) and *laſtly*, proves the *Mechanical* Production of *Forms*: grounding his proof, *partly* upon the Manner, by which ſuch a *Convention of Accidents*, as deſerve to paſs for a *Form*, may be *produced*; as that the Curious Shapes of *Salts* (believed to be the admirableſt Effects and ſtrongeſt Proofs of *Subſtantial Forms*) may be the Reſults of *Texture*; *Art* being able to produce Vitriol as well as *Nature*: *partly*, upon the poſſibility of *Reproducing* Bodies by skill, that have been deprived of their reputed *Subſtantial Forms*: VVhere he alledges the *Redintegration of Saltpetre*, ſuccesfully performed by himſelf; though his Attempts, made upon the diſſipation and re-union of *Amber*, *Allum*, *Sea-Salt*, and *Vitriol*, proved (by reaſon of *accidental* hindrances rather, than of any impoſſibility in the Nature of the Thing) leſs ſucceſful.

In the *Second* and *Hiſtorical* Part, the Author, appealing to the Teſtimony of Nature, to verifie his Doctrine, ſets down, *both* ſome *Obſervations*, of what Nature does without being over-ruled by the power and skill of man; and ſome *Expeviments*, wherein Nature is guided, and as it were, maſtered by Art.

The *Obſervations* are four.

1. The *Firſt* is taken from what happens in the *Hatching of*

an

an Egge; out of the *White* whereof, which is a ſubſtance Similar, inſipid, ſoft, diaphanous, colourleſs, and readily diſſoluble in cold water, there is by the *New* and *Various* contrivement of its ſmall parts, cauſed by the Incubation of the Hen, an Animal produced, ſome of whoſe parts are opacous, ſome red, ſome yellow, ſome white, ſome fluid, ſome conſiſtent, ſome ſolid and frangible, others tough and flexible, ſome well, ſome ill-taſted, ſome with ſprings, ſome without ſprings, *&c.*

2. The *Second* is fetcht from *Water*, which being fluid, taſtleſs, inodorous, diaphanous, colourleſs, volatile, *&c.* may by a *Differing Texture* of its parts, be brought to conſtitute Bodies, having qualities very diſtant from theſe, as *Vegetables*, that have firmeneſs, opacity, odors, taſts, colours, Medicinal vertues; yielding alſo a true *Oyle*, that refuſes to mingle with *Water*, *&c.*

3. The *Third*, from *Inoculation*; wherein, a ſmall *Bud* is able ſo to tranſmute all the ſap, that arrives at it, as to make it conſtitute a Fruit quite otherwiſe qualified, then that, which is the *genuine* production of the Tree, ſo that the ſame ſap, that in one part of the Branch conſtitutes (for Inſtance) a *Cluſter of Haws*, in another part of the ſame Branch, may make a *Pear*. VVhere the Author mentions divers other very conſiderable Effects of Inoculations, and inſerts ſeveral Hiſtories, all countenancing his doctrine.

4. The *Fourth*, from *Putrified Cheeſe*; wherein, the *rotten* part, by the alteration of its Texture, will differ from the *Sound*, in colour, odor, taſte, conſiſtence, vermination, *&c.*

The Experiments are ten.

1. *A Solution of Vitriol and Camphire*; in which by a change of Texture, appear'd the Production of a deep colour from a white

white Body, and a clear Liquor without any external heat: The deſtruction of this Colour, by adding only ſome fair water: The change of an Odorous Body, *as Camphire*, into an Inodorous, by mixing it with a Body, that has ſcarce any ſenſible odour of its own: The ſudden reſtauration of the *Camphire* to its native ſcent and other qualities, by common water, *&c.*

2. *Sublimate, diſtill'd from Copper and Silver*, which both did wholly looſe their Metalline forms, and were melted into brittle lumps, with colours quite differing from their own; both apt to imbibe the moiſture of the Air, *&c.*

3. *A ſolution of Silver into Luna Cornea:* Whereby the opacous, malleable and hardly fuſible Body of *Silver*, was, by the addition of a little ſpirit of ſalt, reduced into Chryſtals, differing from thoſe of other Mettals; diaphanous alſo, and brittle, and far more eaſily fuſible, than Silver; wholly unlike either a Salt or a Mettal, but very like to a piece of *Horn*, and withall inſipid, though the Solution of Silver, be very bitter, and the ſpirit of ſalt, highly ſowre, *&c.*

4. *An Anomalous Salt*; (which the Author had not, it ſeems the liberty to teach the Preparation off) whoſe Ingredients were purely Saline, and yet the Compound, made up only of ſalt, ſowre, and ſtrongly taſted Bodies, was rather *really* ſweet, than of any other taſte, and when a little urged with heat, its odour became ſtronger, and more inſupportable than that of *Aqua fortis*, *diſtilled Urine*, and even *ſpirit of ſalt Armoniack*; but yet when theſe Fumes ſettled again into ſalt, their odour would again prove inoffenſive, if not pleaſant, *&c.*

5. *A Sea-ſalt, whence Aqua fortis had been diſtilled:* Where the Liquor, that came over, proved an *Aqua Regis*: the ſubſtance in the bottom, had not onely a mild taſte, and

affected the Pallat much more like ſalt-peter, than Common ſalt; but was alſo very fuſible, and inflammable, though produced of two un-inflammable bodies: and the ſame ſubſtance, conſiſting of *Acid* ſalts, by a certain way of the Author, produced a *Fixt* ſalt.

6. *Oyle of Vitriol poured upon a Solution of Bay-ſalt:* whence was abſtracted a liquor, that by the ſmell and Taſte appeared to be a ſpirit of ſalt. In which operation, the mixture, by working a great change of Texture, did ſo alter the nature of the compounding Bodies, that the ſea-ſalt, though a conſiderably fixt Body, was diſtill'd over in a moderate Fire of ſand, whilſt the Oyl of Vitriol, though no ſuch groſs ſalt, was by the ſame operation ſo fixt, as to ſtay behind: Beſides that the ſame, by a competent heat yeilded a ſubſtance, though not inſipid, yet not at all of the taſte of Sea-ſalt, or of any other pungent one, much leſs having the highly corroſive acidity of oyl of Vitriol, *&c.*

7. *A diſſolvent, made by pouring a ſtrong ſpirit of Nitre on the rectified Oyl of the Butter of Antimony, and then diſtilling off all the liquor, that would come over, &c.* This *Menſtruum* (called by the Author *Peracutum*) being put to highly refined Gold, deſtroyed its Texture, and produced, after the method preſcribed in the book, a *true Silver*, as its whiteneſs in colour, diſſolublenes in *Aqua fortis*, and odious Bitterneſs, did manifeſt: which change of a Mettal, commonly eſteemed to be abſolutely indeſtructible by Art, though it be far from being *Lucriferous*, is yet exceedingly *Inſtructive*; as is alſo the way, the Author here adds, of *Volatilizing* Gold, by the power of the ſame *Diſſolvent*.

8. *Aqua fortis, concoagulated with differing Bodies*, produced very differing Concretes: And the ſame Numeral Saline Corpuſcles, that being aſſociated with thoſe of one Mettal, had already produced a Body eminent in one Taſte, did af-

ter-

terwards, being freed from that Body, compoſe a Liquor of a very differing taſte; and after *that* too, being combin'd with the parties of another Mettal, did with them conſtitute a Body of a very eminent Taſte, as oppoſite as any one can be to both the other Taſts; and yet theſe Saline Corpuſcles, being inſtead of this ſecond Mettal, aſſociated with ſuch a one as that, they are driven from, did therewith exhibite again the firſt of the three mention'd Taſts.

9. *Water tranſmuted into Earth*, though the Author ſaith of this Tranſmutation, that it was not ſo perfect, as he wiſh'd, and as he hopes to make it.

10. *A mixture of Oyle of Vitriol and Spirit of Wine.* Theſe two Liquors, being of odd Textures in reference to each other, their conjunction and diſtillation made them exhibite theſe *Phænomena*: *vid.* That, whereas Spirit of Wine has no great, nor good ſcent, and moderately dephlegm'd Oyl of Vitriol is wont to be inodorous; the Spirit, that firſt came over from their mixture, had a ſcent not only very differing from Spirit of Wine, but from all things elſe, that the Author ever ſmelt; the Odor being very fragrant & pleaſant, and ſo ſubtle, that in ſpight of the care taken in luting the Glaſſes exactly together, it would perfume the neighbouring parts of the *Laboratory*, and afterwards ſmell ſtrongly at ſome diſtance from the Viol, wherein it was put, though ſtopt with a cloſe Cork, covered with two or three ſeveral Bladders. But, after this volatile and odoriferous Spirit was come over, and had been follow'd by an Acid Spirit, it was at laſt ſucceeded by a ſtrongly ſtinking Liquor, *&c.*

But *Manum de Tabula*: the Book it ſelf will certainly give a ſatisfaction far beyond what here can be ſaid of it.

Some New obſervations about the Planet Mars, *communicated ſince the Printing of the former ſheets.*

There was very lately produced a Paper, containing ſome obſervations, made by Mr. *Hook*, about the Planet *Mars*; in the *Face* whereof he affirmed to have diſcovered, in the late months of *February* and *March*, that there are ſeveral *Maculæ* or *Spotted parts*, changing their place, and not returning to the ſame Poſition, till the next enſuing night near about the ſame time. Whence it may be collected, that *Mars* (as well as *Jupiter*, and the *Earth*, *&c.*) does move about his own *Axis*. of which a fuller account will be given hereafter, God permitting. This ſhort and haſty intimation of it, is intended onely to invite others, that have opportunity, timely to make Obſervations, (either to confirm, or rectify) before *Mars* gets out of ſight.

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PHILOSOPHICAL TRANSACTIONS.

Munday, May 7. 1666.

The Contents.

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A way
Of preserving Birds taken out of the Egge, and other small Fætus's; *communicated by Mr.* Boyle.

THis was imparted in a Letter, as follows;

The time of the year invites me to intimate to you, that among the other Uſes of the Experiment, I long ſince preſented the *Society*, of preſerving Whelps taken out of the Dams womb, and other *Fætus's*, or parts of them, in *Spirit of Wine*; I re-

member, I did, when I was ſollicitous to obſerve the Proceſſe of Nature in the Formation of a Chick, open Hens Eggs, ſome at ſuch a day, and ſome at other daies after the beginning of the Incubation, and carefully taking out the *Embryo's*, embalmed each of them in a diſtinct Glaſs (which is to be carefully ſtopt) in *Spirit of Wine*: Which I did, that ſo I might have them in readineſſe, to make on them, at any time, the Obſervations, I thought them capable of affording; and to let my Friends at other ſeaſons of the year, ſee, *both* the differing appearances of the Chick at the third, fourth, ſeventh, fourteenth, or other daies, after the Eggs had been ſate on, *and* (eſpecially) ſome particulars not obvious in Chickens, that go about; as the hanging of the Gutts out of the *Abdomen*, &c. How long the tender *Embryo* of the Chick ſoon after the *Punctum ſaliens* is diſcoverable, *and* whilſt the Body ſeems but a little Organixed Gelly, *and* ſome while after *That*, will be this way preſerv'd, without being too much ſhrivel'd up, I was hindred by ſome miſchances to ſatisfie my ſelf: but when the *Fætus's*, I took out, were ſo perfectly formed as they were wont to be about the ſeventh day, and after, they ſo well retain'd their ſhape and bulk, as to make me not repent of my curioſity: And ſome of thoſe, which I did very early this Spring, I can yet ſhew you. I know I have mention'd to you an eaſie application of what I, ſome years ſince, made publick enough; but not finding it to have been yet made by any other, and being perſwaded by Experience, that it may be extended to other *Fætus's*, which this ſeaſon (the *Spring*) is time to make proviſion off, I think the *Advertiſement* will not ſeem unſeaſonable to ſome of our Friends; though being now in haſte, and having in my thoughts divers particulars, relating to this way of Preſerving Birds taken out of the Egge, and other ſmall *Fætus's*, I muſt content my ſelf to have mention'd that, which is *Eſſential*, leaving divers other things, which a little practiſe may teach the Curious, unmention'd. Notwithſtanding which, I muſt not omit theſe two Circumſtances; the *one*, that when the Chick was grown big, before I took it out of the Egge, I have (but not conſtantly) mingled

mingled with the *Spirit of Wine*, a little Spirit of *Sal Armoniack*, made (as I have elsewhere delivered) by the help of *Quick-lime*: which Spirit I choose, because, though it abounds in a Salt not Sowre, but Urinous, yet I never observed it (how strong soever I made it) to coagulate Spirit of Wine. The *other* circumstance is, that I usually found it convenient, to let the little *Animals*, (I meant to imbalme, lie for a little while in ordinary Spirit of Wine, to wash off the looser filth, that is wont to adhere to the Chick, when taken out of the Egge; and then, having put either the same kind of Spirit, or better upon the same Bird, I suffer'd it to soak some hours (perhaps some daies, *pro re nata*) therein, that the Liquor, having drawn as it were what Tincture it could, the *Fœtus* being remov'd into more pure and well dephlegm'd Spirit of Wine, might not dis colour it, but leave it almost as limpid, as before it was put in.

In the usefulness of Experimental Philosophy.

An Extract

Of a Letter, sent lately to Sir Robert Moray *out of* Virginia, *concerning an* unusual *way of propagating* Mulberry trees *there, for the better improvement of the* Silk-Work; *together with some other particulars, tending to the good of that* Plantation.

I am disappointed at this time of some Rarities of Minerals, Mettals, and Stones; but you may have them any other time, as conveniently, *&c.* I have planted here already ten thousand *Mulberry trees*; and hope, within two or three years, to reap good silk of them. I have planted them in a way unusual here, which advances them two or three years growth, in respect of their being sown in seed: And they are now, at writing hereof all holding good, although this has been a very long and bitter winter with us, much longer and colder, than ever I did find it in *Scotland* or *England*. I intend likewise to plant

them all, as if they were *Currants* or *Goos-berries*, ſo thick as hedges; whereby one man may gather as many of them, as otherwiſe, when they are planted in trees at diſtance, four perſons may do. Expedient is the benefit of this Trade. Having diſcourſed of this new way to all here; they are generally inclinable to it; conſidering that the Planting their Trees, as before, at diſtance, and letting them grow high, has been the main obſtruction of that work hitherto, and the loſs of their time and gain: but being in hedges, they will be always young tender plants; and conſequently will be eaſily cut in great quantites with a pair of Garden Sizzers. But there may be ſuggeſted yet another, and perhaps a better way; which is, to ſowe ſome Acres with *Mulberry ſeed*, and to cut it with a ſith, and ever to keep it under. I have alſo bethought my ſelf of a new way, for a few hands to ſerve many Worms, and that more cleanly than before: which alſo will be a means, without more trouble or pains, to ſeparate unhealthy worms from healthful; and by which a great many more may be kept in a room, than otherwiſe upon ſhelves, as is uſual here. Beſides this, I have ſown a little *French-Barley* and *Rice ſeed*, and am thinking on a way of un-husking them with expedition, and ſo preparing them for the Merchant, as they uſe to be: But if you can inform me, how they are prepared, you may ſave me ſome labour. If I had any *Coffee* in husks, or any other vegetable commodity, from the Streights to try, I would here make tryal with them. Its like, that ſome of thoſe Merchants that are of your *Society*, and keep a Correſpondency there, may aſſiſt in procuring them. By the latter ſhips I intend to ſend you a New ſort of ſweet ſented *Tobacco*, which I have not yet had time to improve.

A Method, by which a Glaſs of a ſmall Plano-convex Sphere may be made to refract the Rayes of light to a Focus *of a far greater diſtance, than is uſual.*

This is propoſed by Mr. *Hook*, in conſequence of what was men-

mention'd from him in *Numb.* 4 *pag.* 67, of theſe *Tranſactions.*

Prepare (*ſaith he*) two Glaſſes, the one exactly flat on both ſides, the other flat on the one ſide, and convex on the other, of what Sphere you pleaſe. Let the flat Glaſs be a little broader than the other. Then let there be made a Cell or Ring of Braſs, very exactly turn'd, into which theſe two Glaſſes may be ſo faſtned with Cement, that the plain ſurfaces of them may lye exactly paralell, and that the Convex-ſide of the Plano-convex-Glaſs may lye inward; but ſo, as not to touch the flat of the other Glaſs. Theſe being cemented into the Ring very cloſely about the edges, by a ſmall hole in the ſide of the Braſs-ring or Cell, fill the interpoſed ſpace between theſe two with *Water*, *Oyl of Turpentine*, *Spirit of Wine*, *Saline Liquors*, *&c*; then ſtop the hole with a ſcrew: and according to the differing refraction of the interpoſed Liquors, ſo ſhall the *Focus* of this compound Glaſs be longer or ſhorter.

But this (adds the *Propoſer*) I would only have look't upon, as one inſtance of many (for there may be others) of the *Poſſibility* of making a Glaſs, ground in a ſmaller Sphere, to conſtitute a Teleſcope of a much greater length: Though (not to raiſe too great exſpectation) I muſt add, That of *Spherical* object glaſſes, thoſe are the beſt, which are made of the greateſt Sphere, and whoſe ſubſtance hath the greateſt refraction.

Obſervations About Shining Worms *in Oyſters.*

Theſe Obſervations occur in the *French journal* of *April* 12. 1666. in two letters, written by M. *Auzout* to M. *Dela-Voye*; whereof the ſubſtance may be reduced to the following particulars.

1. That M. *Dela Voye* having obſerved, as he thought, ſome-

ſome ſhining Worms in Oyſters; M. *Auzout*, being made acquainted with it, did firſt conceive, they were not Worms (unleſs they were cruſhed ones) that ſhin'd, as having not been able then to diſcern any parts of a Worm; but only ſome ſhining clammy moyſture; which appeared indeed like a little Star of a blewiſh colour, and ſtuck to the Oyſter-ſhell; being drawn out, ſhone in the Air its whole length (which was about four or five lines,) and when put upon the *Obſervers* hand, continued to ſhine there for ſome time.

2. That M. *Auzout* afterwards, cauſing more than 20. douzen of Oyſters to be open'd at Candle-light, really ſaw, in the dark, ſuch ſhining worms in them; and thoſe of three ſorts. *One* ſort was whitiſh, having 24. or 25. feet on each ſide, forked; a black ſpeck on one ſide of the head (taken by him for a *Chryſtallin*) & the back like an Eele, ſtript off her skin The *ſecond*, red, and reſembling the common *Glow-worms*, found at Land, with folds upon their backs, and feet like the former; and with a noſe like that of a dog, and one eye in the head The *third* ſort was ſpeckled, having a head like that of a Sole, with many tufts of whitiſh hair on the ſides of it,

3. That, beſides theſe, the *Obſerver* ſaw ſome much bigger, that were grayiſh, with a big head, and two horns on it, like thoſe of a Snayl, and with 7. or 8. whitiſh feet, but theſe, though kept by him in the night, ſhin'd not.

4. That the two firſt ſorts are made of a matter eaſily reſoluble, the leaſt ſhaking or touch turning them into a viſcous and aqueous matter; which falling from the ſhell, ſtuck to the *Obſervers* fingers, and ſhone there for the ſpace of 20. ſeconds: and if any little part of this matter, by ſtrongly ſhaking the ſhell, did fall to the ground, it appear'd like a little piece of a flaming Brimſtone; and when ſhaken off nimbly, it became like a ſmall ſhining Line, which was diſſipated before it came to the ground.

5. That

5. That this ſhining matter was of different colour; ſome, whitiſh, ſome, reddiſh; but yet that they afforded both, a light which appear'd a violet to his eye.

6. That it is very hard to examine theſe worms entire (eſpecially the white ones) becauſe that at the leaſt touch they doe burſt, and reſolve into a glutinous moyſture; whence alſo if it were not for their feet, that are diſcover'd in their matter, none would judge them to be Worms.

7. That among thoſe, which he obſerved, he ſaw two more firm, than the reſt, which ſhone all over; and when they fell from the Oyſter, twinkled like a great ſtar, ſhining ſtrongly, and emitting rays of a violet-light by turns, for the ſpace, (as touch't above) of 20. ſeconds. Which Scintillation the *Obſerver* imputes to this, that thoſe worms being alive, and ſometimes raiſing their head, ſometimes their tayle, like a Carpe, the light increaſed and leſſened accordingly; ſeeing that, when they ſhone not, he did, viewing them by a Candle, find them dead.

8. That forcibly ſhaking the Oyſter-ſhells in the dark, he ſometimes ſaw the whole ſhell full of lights, now and then as big as a fingers end; and abundance of this clammy matter, both red and white, (which he judges to have been Worms) burſt in their holes.

9. That in the ſhaking he ſaw all the Communications of theſe little Verminulous holes, like to the hole of Worms in Wood.

10. That in more than 20 douzen of Oyſters he ſhook no ſhell (10. or 12. excepted) but it emitted light: And found ſome of this light in ſixteen of the Oyſters themſelves.

11. That this light occurs more frequently in big, than ſmall Oyſters; in thoſe that are pierced by the Worm, oftner, than

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in thoſe that are not, and rather upon the Convex-ſide, than the other; and more in freſh ones, than in the ſtale.

12. That having ſomewhat ſcaled the Convex-ſide of the ſhell, and diſcover'd the Communication of the holes, wherein the often-mention'd viſcous moyſture, that has any form of inſects, is found; he ſmelt a ſcent, that was like the water of a ſqueeſed Oyſter.

13. That the Worms give no light, when irritated, but if they do, the light laſts but a very little time, whereas that which appears in thoſe, that were not angred before, continues a great while; the *Obſerver* affirming to have kept of it above 2 hours.

So far the *Journal des Scavans*; which intimates withal, that if the *Obſervers* had had better *Microſcopes*, they could have better examin'd this matter.

But ſince the curious here in *England* are ſo well furniſh with good ones, 'tis hoped, that they will employ ſome of them for further and more minute Obſervations of theſe Worms; it being a matter, which, joyned with other Obſervations, already made by ſome excellent perſons here, (eſpecially Mr. *Boyle*) upon this ſubject of Light, may prove very luciferous to the doctrine of it, ſo much yet in the dark.

Some Obſervations
Of the Effects of Touch *and* Friction,

The Operations and Effects of *Touch* and *Friction* having been lately much taken notice off, and being lookt upon by ſome, as a great *Medical* Branch, for the curing of many diſeaſes and infirmities; it will perhaps not be unſeaſonable to mention (here alſo) ſome Obſervations relating thereunto; which may give an occaſion to others, to conſider this ſubject more, than has been done heretofore, and to make further

ther Obſervations and Tryals concerning the power of the ſame.

And *Firſt*, the Illuſtrious Lord of *Verulam*, in his *Hiſtory of Life and Death*; Hiſtor. 6. §. 3. obſerves, That *Motion* and *Warmth* (of which two, *Friction* conſiſts) draws forth, into the parts, New Juyce and Vigour. And *Canon*. XIII. he affirms, That *Frictions* conduce much to *Longevity*. See the ſame, *Connex*. ix. §. 26. *&c*.

Secondly, The Honourable *Robert Boyle*, in his *Uſefulneſs of Experimental Philoſophy*, *ſect*. 2. *ch*. 15. conſidering the Body of a Living man or any Animal, as an Engine, ſo compoſed, that there is a conſpiring communication betwixt its parts, by vertue whereof a very ſlight impreſſion of adventitious matter upon ſome one part, may be able to work, on ſome other diſtant part, or perhaps on the whole Engine, a change far exceeding, what the ſame adventitious matter could do upon a Body not ſo contrived: Repreſenting, I ſay, an Animal in this manner, and thence inferring, how it may be alter'd for the better or worſe by motions or impulſes, confeſſedly *Mechanicall*, obſerves, How ſome are recover'd from ſwouning fits by pricking; others grow faint and do vomit by the bare motion of a Coach; others fall into a troubleſome ſickneſs by the agitation of a Ship, and by the Sea-air (whence they recover by reſt, and by going a ſhore.) Again, how in our Stables a Horſe well-curried is half-fed: How ſome can tell by the Milk of their Aſſes, whether that day they have been well curried or not: Arguing hence, that if in *Milk* the alteration is ſo conſiderable, it ſhould be ſo likewiſe in the *Blood*, or other Juyces, of which the Blood is elaborated, and conſequently in divers of the principal parts of the Body. Where alſo (upon the authority of *Piſo*) he refers the Reader to the *Braſilian* Empiricks, whoſe

wild *Frictions*, as unskilfully as they order them, do ſtrange things, both in *preſerving health*, and *curing diſeaſes*; curing Cold and *Chronical* ones by *Friction*, as they do *Acute* ones, by *Unction*.

Thirdly, The learned Dr. *John Beale*, did not long ſince communicate by ſome Letters; *Firſt*, that he could make good proof of the curing or killing a very great and dangerous *Wen* (that had been very troubleſome for two or three years,) by the application of a dead mans hand, whence the Patient felt ſuch a cold ſtream paſs to the Heart, that it did almoſt cauſe in him a fit of ſwouning *Secondly*, that, upon his brothers knowledge, a certain Cook in a Noble Family of *England* (wherein that brother of his then lived) having been reproached for the uglineſs of his *Warty* hands, and return'd for anſwer, that he had tried many remedies, but found none, was bid by his Lord, to rub his hand with that of a dead man; and that this Lord dying ſoon after, the Cook made uſe both of his Lords adviſe and hand, and ſpeedily found good effect. (Which is alſo confirm'd by what Mr. *Boyle* relates in his lately mentioned *Book*, of Dr. *Harvey's* frequently ſucceſſull triall, of curing ſome Tumors or Excreſcencies, by holding on them ſuch a Hand.) Here is *Friction* or *Touch*, to mortifie Wens, to drive away ſwellings and Excreſcencies: And why not to repell or diſſipate Spirits, that may have a dangerous influence upon the Brain, or other parts; as well as to call forth the retired ones into the habit of the Body, for Invigoration? *Thirdly*, that a Gentleman, who came lately out of *Ireland*, lay at his Houſe, and inform'd him of an aged Knight there, who having great pain in his feet, inſomuch that he was unable to uſe them, ſuffered, as he was going to bed, a loving *Spaniell* to lick his feet; which was for the preſent very pleaſing to him, ſo that he uſed it mornings and evenings, till he found the pain appeaſed, and the uſe of his feet reſtored. This, ſaith

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the *Relator*, was a gentle touch, and tranſpiration; for he found the Spirits tranſpire with a pleaſing Kind of Titillation. *Fourthly*, that he can aſſure of an honeſt Blackſmith, who by his healing hand converted his Barrs of Iron into Plates of Silver; and had this particular faculty, that he cauſed Vomitings by ſtroaking the Stomack; gave the Stool by ſtroaking the Belly; appeaſed the Gout, and other paines, by ſtroaking the parts affected.

Some particulars, communicated from forraign parts, concerning the Permanent Spott *in* Jupiter; *and a Conteſt between two Artiſts about* Optick Glaſſes, *&c.*

Euſtachio de Divinis (ſaith the *Informer*,) has written a large Letter, wherein he pretends, that the Permanent Spot in *Jupiter* hath been firſt of all diſcovered with *his* Glaſſes; and that the P. *Gotignies* is the firſt that hath thence deduced the Motion of *Jupiter* about his *Axis*; and that Signior *Caſſini* oppoſed it at firſt; to whom the ſaid *Gotignies* wrote a letter of complaint thereupon.

See Numb. 1. *of thoſe* Tranſactions; *by the date whereof it will appeare, that that* Spot *was obſerved in* England, *a good while before any ſuch thing was ſo much as heard of.*

The ſame *Euſtachio* pretends likewiſe, that his great Glaſſes excell thoſe of *Campani*; and that in all the tryals, made with them, they have performed better; and that *Campani* was not willing to do, what was neceſſary for well comparing the one with the other. *viz.* To put equall *Eye-glaſſes* in them, or to exchange the ſame Glaſſes.

The ſaid *Divini* affirms alſo, that he hath found a way to

know, whether an Object-glaſs be good or not, onely by looking upon it, without trying. This would be of good uſe, eſpecially if it ſhould extend ſo far as to diſcerne the goodneſs of ſuch a glaſs, whilſt it is yet on the Cement.

An Account

Of Dr. Sydenham's *Book, entituled,* Methodus Curandi Febres, Propriis obſervationibus ſuperſtructa.

This *Book* undertakes to deliver a more certain and more genuine Method of curing Feavers and Agues, than has obtained hitherto: And it being premiſed, *Firſt*, that a Fever is Natures Engine, ſhe brings into the field, to remove her enemy; or her handmaid, either for evacuating the impurities of the blood, or for reducing it into a New State: *Secondly*, that the true and genuine cure of this ſickneſs conſiſts in ſuch a tempering of the Commotion of the Blood, that it may neither exceed, nor be too languide: This, I ſay, being premiſed by the Author, he informs the Reader;

In the *Firſt Section*, of the different Method, to be employed in the cure of Feavers, not only in reſpect of the differing conſtitutions and ages of the patients, but alſo in regard of the differing ſeaſons of one and the ſame year, and of the difference of one year from another. As to the *Former*, he ſhews, in what ſorts of *Patients*, and at what time of the Feaver, Phlebotomy, or Vomiting, or both, are to be uſed; and when and where not: In what ſpace of time the *Depuration* if nature be not diſturbed or hindred in her work, will be perform'd: When *Purgatives* are to be adminiſtred: How that *Diarrhea's* happen, if the *Patient* had in the beginning

ning of the Feaver an inclination to vomit, but no vomit was given; and that thoſe ſymptoms, which commonly are imputed to a malignity, do, for the moſt part, proceed from the Relaxation of the tone of the Bloud, cauſed by Medicines too refrigerating, or by the unſeaſonable uſe of Gliſters in the declination of the diſeaſe. As to the *Latter*, he obſerves, that one of the chief cauſes, rendring the Cure of Feavers ſo uncertain and unſucceſsfull, is, that *Practitioners* do accommodate their obſervations, they take from the ſucceſsful cure of ſome Feavers in one ſeaſon of the year, or in ſome one year, to that of all Feavers in any ſeaſon, or in any year whatſoever. And here he obſerves, *firſt*, how vigorous the blood is in the *Spring*, and how diſpirited in *Autumn*; and thence regulates the letting of bloud, and Vomiting, and the giving of Gliſters. *Next*, how difficult it is, to aſſign the cauſe of the difference between the Feavers of *Several years*; and to prognoſticate of the ſalubrity or inſalubrity of the following part of the year: where yet he inſinuates, that, when *Inſects* do ſwarm extraordinarily, and when Feavers and Agues (eſpecially *Quartans*) appear very early, as about *Midſummer*, then *Autumn* commonly proves very ſickly. *Laſtly*, what method and Cautions are to be uſed in the Cure of *Epidemical* Feavers.

In the *Second Section*, he treats of the *Symptoms*, accompanying *Continued* Feavers; as *Phrenſies*, *Pleuriſies*, *Coughs*, *Hicoughs*, *Fluxes*, *&c.* Shewing, both whence they are cauſed, and how they are to be cured: Where having inſerted a conſiderable *Paragraph*, touching a certain *Symptomatical* Feaver in the *Spring*, to be cured like Pluriſies; he mentions among many Obſervables, this, as a chief one, that *Laudanum*, or any other *Narcotick* given againſt the *Phrenſy*, in the beginning, progreſs, or height of a Feaver, does rather hurt, than good, but in the declination thereof, is uſed with good ſucceſs. To all which he ſubjoins a particular accompt

compt of the *Iliac Paſſion* (eſteem'd by him to be ſometimes a *Symptome* alſo of Feavers;) not only diſcourſing of its cauſe (a prepoſterous inverſion of the Inteſtins, proceeding either from Obſtruction, or Irritation,) but adding alſo a very plain way of Curing the ſame; and that not by the uſe of *Quick-ſilver* or *Bullets* (by him judged to be frequently noxious) but only by *Mint-water*; and the application of a Whelp to the Patients ſtomach; to ſtrengthen the ſame, and to reduce it again to its natural motion.

In the *Third Section*, he treats of *Intermittent* Feavers, or of *Agues*: Where he diſcourſes of the times of the *Cold* and *Hot* fits, and of *that* of the *Separation* of the ſubdued aguiſh matter: Finds difficulty in giving a ſatisfactory accompt of the *return of Fits*: diſtinguiſhes Agues into *Vernal* and *Autumnal*: Takes notice, that as there are few *Continued* Feavers, ſo generally there are only *Quotidians* and *Tertians*, in the *Spring*; and only *Tertians* and *Quartans* in *Autumn*; Of which having offered Reaſons, that ſeem conſiderable, he proceeds to his Method of curing them; and, laying much weight upon the ſaid difference, he preſcribes and urges different ways to be uſed in that cure: Interſerting among other things theſe notes; *Firſt*, that the Period of Fermentation in Feavers, both *Continued* and *Intermittent*, is (if left to Natures own conduct, and well regulated, if need be, by Art) perform'd in about 336. hours or 14 dayes; ſubducting in *Intermittent* ones, the hours of intermiſſion, and counting $5\frac{1}{2}$ hours for every Paroxiſm; and imputing the excurſion beyond that time to the diſturbance given to nature by the error of Practitioners. *Secondly*, that whoever hath had a *Quartan* formerly, though many years be paſſ'd, ſhall, if he chance to have another, be *ſoon* freed from it; and that a Phyſician knowing *that*, may confidently predict *this*.

In

In the *Fourth Section*, the Author, in conformity to the Cuſtom of thoſe that write of Feavers, diſcourſes of the *Small-pox*; and *Firſt*, examining the cauſe of this ſickneſs and its univerſality, delivers his peculiar opinion of the bloud's endeavouring a Renovation or a New Texture (once at leaſt in a Mans life) and is inclin'd to preferr the ſame to the received doctrine of its malignity. *Then*, having laid down, for a foundation of the Cure, the two times, of *Separation* and *Expulſion*, he argues as well againſt too high an Ebullition or too haſty a ſeparation (by a hot diet or high Cordials) as againſt too languid a one (by Blooding, Purges, and Cooling medicines.) The like he does to the Time of *Expulſion*, forbidding *both* immoderate Heat (whereby Nature's expelling operation is diſturbed by a precipitated and too thick a crowd of the protruded puſtuls,) *and* too much Cooling, whereby due Expulſion is hindred. In ſhort, he adviſes, to permit Nature to do her own work, requiring nothing of the Phyſician, but to regulate her, when ſhe is exorbitant, and to fortifie her, when ſhe is too weak. He concludes all, with delivering a Model of the Method, he would uſe for his own only Son, if he ſhould fall into this Sickneſs.

Advertiſement.

Whereas 'tis taken notice of, that ſeveral perſons perſwade themſelves, that theſe Philoſophical Tranſactions *are publiſh't by the* Royal Society, *notwithſtanding many circumſtances, to be met with in the already publiſh't ones, that*

that import the contrary; The Writer thereof hath thought fit, expresly here to declare, that that perswasion, if there be any such indeed, is a meer mistake; and that he, upon his Private *account (as a Well-wisher to the advancement of usefull knowledge, and a Furtherer thereof by such Communications, as he is capable to furnish by that Philosophical Correspondency, which he entertains, and hopes to enlarge) hath begun and continues both the composure and publication thereof: Though he denies not, but that, having the honour and advantage of being a* Fellow *of the said* Society, *he inserts at times some of the Particulars that are presented to them; to wit, such as he knows he may mention without offending them, or transgressing their Orders; tending only to administer occasion to others also, to consider and carry them further, or to Observe or Experiment the like, according as the nature of such things may require.*

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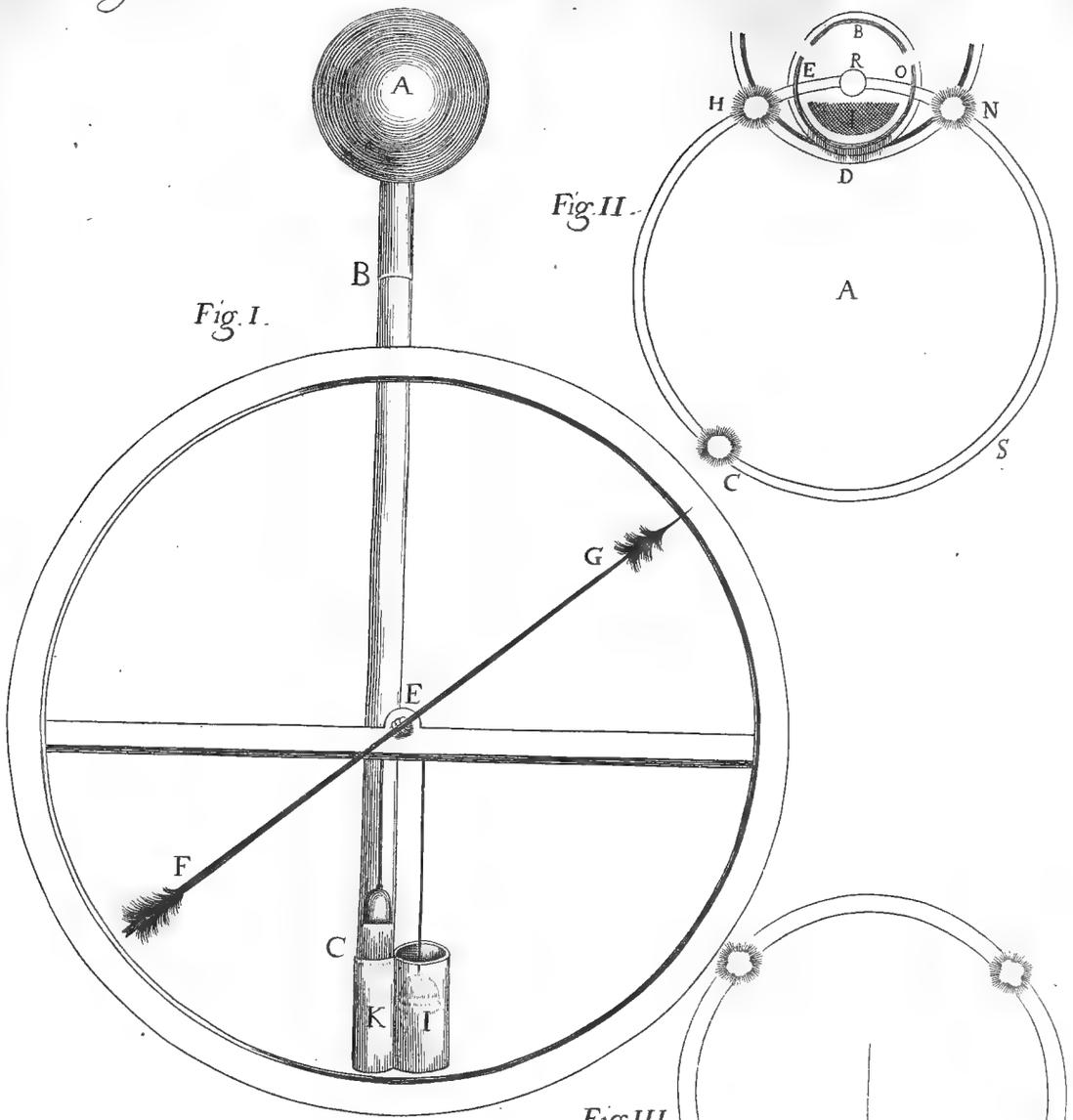

Fig. I.

Fig. II.

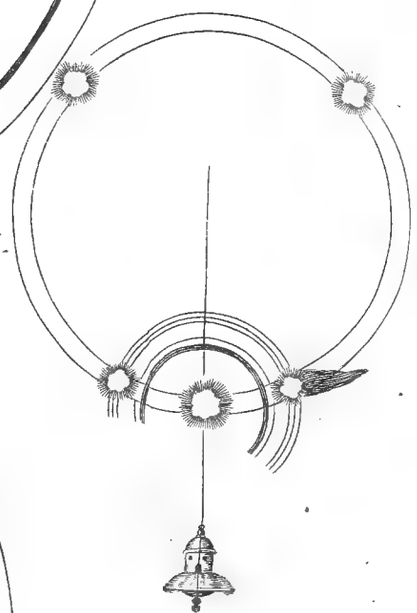

Fig. III.

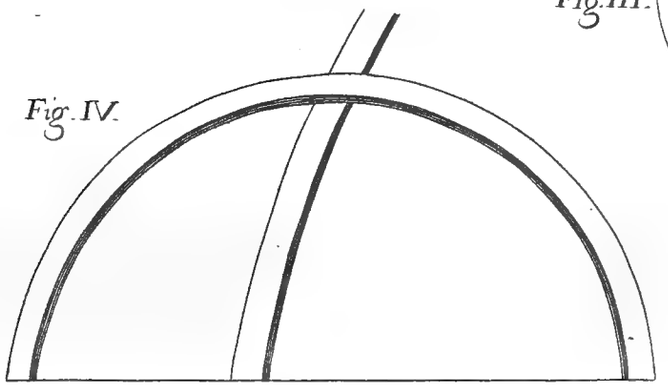

Fig. IV.

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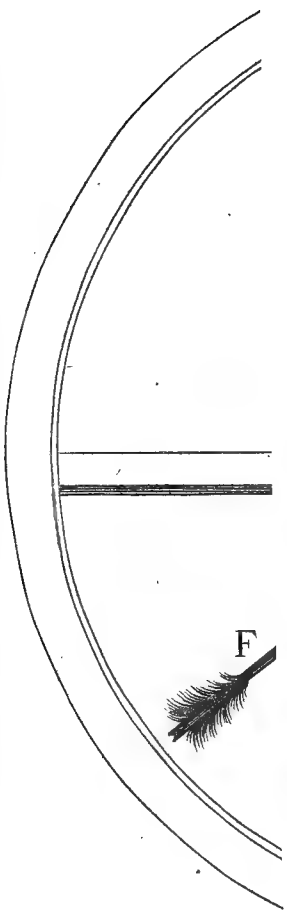

Fig. IV.

PHILOSOPHICAL TRANSACTIONS.

Munday, June 4. 1666.

The Contents.

Certain Problems *touching ſome Points of Navigation. Of a new Contrivance of* Wheel-Barometer, *much eaſier to be prepar'd, than others. An account of* Four Suns *which lately appeared in* France; *and of two, unuſually poſited,* Rainbows, *ſeen in the ſame Kingdom. A Relation of an Accident, by Thunder and Lightning, in* Oxford. *An Experiment, to examine, what* Figure *or Celerity of Motion begetteth or increaſeth* Light *and* Flame. *Some Conſiderations touching a Letter in the* Journal des Scavans *of* May 24. 1666.

Certain Problems *Touching ſome Points of* Navigation.

THeſe *Problems* are preſented by the Learned and Induſtrious *Nicolaus Mercator*, for the advancing of that Excellent and Beneficial Science, *Navigation*, as follows:

The line of *Artificial Tangents*, or the *Logarithmical Tangent-line*, beginning at 45. deg. and taking every half *degree* for a whole one, is found to agree pretty neer with the *Meridian-line* of the *Sea-Charte*; they both growing, as it were, after the ſame Proportion. But the Table of *Meridional* degrees being calculated onely to every *Sexageſimal* minute of a degree, ſhews ſome ſmall difference from the ſaid *Logarithmical Tangent-line*. Hence it may be doubted, whether that difference doe not ariſe from that little errour, which is committed by calculating the Table of *Meridional* degrees *onely* to every minute.

Mr. *Oughtred* in the V I. *Chap.* of his *Navigation*, annexed to the Book, entituled, *The Circles of Proportion, and the Horizontal Inſtrument*, &c. mentions an Artifice, by himſelf diſcover'd, by which it may be effected, that the ſmall parts of the *Meridian* be not *one* minute (which on the face of the *Earth* anſwers to above an *Engliſh* Mile) but the hundred-thouſanth, or, if need be, the millioneth part of a minute, ſcarce exceeding one fifteenth part of an Inch: Which thing, *he ſaith*, , he is able to perform in *Tables* unto the *Radius* 10000000; yet nothing at all differing either in their form or manner of working from thoſe that are now commonly in uſe.

But which way this is to be done, this *Author* hath not made known to the Publick. And, though ſuch *Tables* unto the *Radius* 10000000. had been brought to light, yet would they not be ſufficient to prove the identity or ſameneſs of the ſaid two Lines, as to continue the compariſon between them as far, as the one of them, *videl.* the *Logarithmicall Tangent-line*, is already calculated, that is, to Ten places, beſides the *Characteriſtick*.

Now therefore, if a certain Rule could be produced, by which the Agreement or Diſagreement of the ſaid two Lines might be ſhew'd, not onely to that Extent of places, to which that *Tangent-line* is already calculated, but alſo to as many more, as the ſame may be yet further extended unto, in *infinitum uſque*; ſurely that rule would not onely ſave us the labour of making *Tables* unto the *Radius* 10000000; but alſo the *Helix* or Spiral Line of the Ships Courſe would be reduced to a more preciſe exactneſs, than ever was pretended by Him: and this moſt Noble and Uſeful Science (as He juſtly calls it) which is the Bond of moſt disjunct Countries, and the Conſociation of Nations fartheſt remote, would attain its full luſtre and perfection.

Beſides, that the ſame Rule would alſo diſcover a far eaſier way of making *Logarithmes*, than ever was practiſed or known; and therefore might ſerve, when ever there ſhould be occaſion, to extend the *Logarithmes* beyond that number of places, that is already extant.

Moreover ſuch a Rule would enable men to draw the *Meridian* line *Geometrically*, that is, without *Tables* or *Scales*: which indeed might

might alſo be done, by ſetting of the *Secants* of every whole or half degree, if there were not this Inconveniency in it (which is not in my Rule:) That a Line compoſed of ſo many ſmall parts, would be ſubject to many errours, eſpecially in a ſmall compaſs.

The ſame Rule alſo will ſerve, to find the Courſe and Diſtance between two Places aſſigned, as far, as practice ſhall require it; and that, without any Table of *Meridional* parts, and yet with as much eaſe and exactneſs.

And ſeeing all theſe things do depend on the ſolution of this Queſtion, *Whether the Artificial Tangent-line be the true Meridian-line?* It is therefore, that I undertake, by God's aſſiſtance, to reſolve the ſaid Queſtion. And to let the world know the readineſs and confidence, I have to make good this undertaking, I am willing to lay a *Wager* againſt any one or more perſons that have a mind to engage, for ſo much as *another Invention* of mine (which is of leſs ſubtlety, but of far greater benefit to the publick) may be worth to the Inventor,

For, the great advantage, that all Merchants, Marriners, and conſequently the Common-wealth, may receive from this *other Invention*, is, in my judgment, highly valuable; ſeeing it will oftentimes make a ſhip ſaile, though, according to the common way of ſailing, the wind be quite contrary, and yet as near to the place intended, as if the wind had been favourable: Or, if you will, it will enable one to gain ſomething in the intended way, whether the wind be good or no (except onely when you go directly South or North,) but the advantage will be moſt, where there is moſt need of it, that is, when the Wind is contrary: So that one may very often gain a fifth, fourth, third part, or more of the intended voyage; according as it is longer or ſhorter; *viz.* always more in a longer Voyage, where the gain is more conſiderable, and more welcome; not only by ſaving Time, but alſo Victuals, Water, Fuel, Mens health, and ſo much Room in the ſhip.

All this, which is here pretended, the Propoſer is to make good by the Verdict of ſome Able Men, who alſo may give a gueſs, what this latter Invention may be worth to the owner: And for ſo much, and no more, he will ſtand engaged againſt a-

ny one or more Perſons, that he will and ſhall reſolve the *Queſtion* above-mention'd, *viz. Whether the Artificial Tangent-line be the true Meridian-line, yea or no?* And if he do not, that then He will looſe, and tranſport to the other Party the whole benefit of the laſt mentioned invention. But if, on the contrary, he do prove or diſprove the Identity of the ſaid two lines, to the Judgment of ſome able *Mathematicians*, That then ſo much money be paid him by the other Party, as the ſaid Invention was valued.

And, whereas there are often Wagers laid about things that concern the Engagers little or nothing; 'tis thought, that it would concern all Merchants, Marriners, and all Lovers of the common good, rather to lay wagers againſt one another about things of this Nature, where the Gainer doth gain as well, as if he had laid his wager about ſomething elſe; and the Looſer hath ſo far the benefit as well as the Gainer, That he ſeeth thereby promoted the thing, that concerns them both alike.

Now therefore, to the end, that the Looſer may have his benefit by it, as well as the Gainer, it would not be amiſs, that the condition were made thus, that the latter ſhould grant the moity of his gain to the Propoſer; that thereby he might be enabled to bring to light both thoſe, and ſome other uſeful inventions, for the Service of Mankind. And to manifeſt, that it is not for his own intereſt onely, that the *Propoſer* mentions this; he is willing to impart from that moity, ſo received, the full moity again to any other perſon within his Majeſties Dominions, who ſhall firſt of all give notice of his Undertaking to prove or diſprove the ſaid Identity, and perform it accordingly within the ſpace of two Months, to be computed from the preſent Date. Thoſe that have a mind to engage, may repair to the Printers of theſe *Tracts*, where they may know further.

A new Contrivance of Wheel-Barometer, *much more eaſy to be prepared, than that, which is deſcribed in the* Micrography; *imparted by the Author of that Book.*

This is only an eaſie way of applying an *Index* to any *Common Baroſcope*, whether the Glaſs be only a Single Cane, or have a round Bolthead at the top. And by the means thereof, the

Variation

Variation of the Altitude of the *Mercurial* Cylinder, which at moſt is hardly three Inches, may be made as diſtinguiſhable, as if it were three Foot, or three Yards, or as much more, as is deſired.

The manner hereof is viſible enough by *Figure* I: where A B C repreſents the Tube, which may be either Blunt, or with a Head, as A B C (by which latter ſhape, more room is allow'd for any remainder of Air, to expand the better.) This is to be filled with Quickſilver, and inverted as commonly; but into a Veſſel of Stagnant Mercury, made after the faſhion of I K, that is, having its ſides about 3 or 4 inches high, and the Cavity of it equally big both above and below; and if it can be (beſides that part, which is fill'd by the end of the *Mercuriall* Tube, that ſtands in it) of equal capacity with the hollow of the Cane about B: For then the Quickſilver riſing as much in the hollow of I, as it deſcends at B, the difference of the height in the Receiver I, will be juſt half the uſual difference. And if the receiving Veſſell IK have a bigger Cavity, the difference will be leſs, but if leſs, the difference will be greater: But, whether the difference be hereby made bigger or leſs, 'tis no great matter, ſince by the contrivance of the *Wheel* and *Index* (which is more fully deſcribed in the *Preface* to the *Micrography*) the leaſt variation may be made as ſenſible as is deſired, by diminiſhing the bigneſs of the Cylinder E, and lengthening the *Index* F G, according to the Proportion requiſite.

An Account
Of Four Suns, *which very lately appear'd in* France, *and of* two Raine-bows, *unuſually poſited, ſeen in the ſame Kingdom, ſomewhat longer agoe.*

Theſe *Phænomena* are thought worthy to be inſerted here, for the Speculation of the Curious in thoſe Kingdoms; as they were publiſht in the French *Journal des Scavans*, of *May* 10. 1666. *viz.*

The 9th of *April* of this preſent year, about half an hour paſt nine, there appear'd three Circles in the ſky. *One* of them was very great, a little interrupted, and white every where, without

the

the mixture of any other colour. It paſſed through the midſt of the Sun's *Diſk*, and was parallel to the *Horizon*. Its *Diameter* was above a hundred degrees, and its *Center* not far from the *Zenith*.

The *Second* was much leſs and defective in ſome places, having the Colours of a Rainbow, eſpecially in that part, which was within the great Circle. It had the true Sun for its Center.

The *Third* was leſs, than the firſt, but greater than the ſecond; it was not entire, but only an Arch or Portion of a Circle, whoſe Center was far diſtant from that of the Sun, and whoſe circumference did, by its middle, joyn to that of the leaſt Circle, interſecting the greateſt Circle by its two extreams. In this Circle were diſcerned alſo the Colours of a Rainbow, but they were not ſo ſtrong, as thoſe of the *Second*.

At the place, where the circumference of this *Third* Circle did cloſe with that of the *Second*, there was a great brightneſs of Rainbow-Colours, mixt together: And at the two extremities, where this *Second* Circle interſected the *Firſt*, appear'd two *Parhelia's* or Mock-ſuns, which ſhone very bright, but not ſo bright, nor were ſo well defined, as the true Sun. The Falſe Sun, that was towards the *South*, was bigger, and far more luminous, then that towards the *Eaſt*. Beſides thoſe two *Parhelia's*, which were on the two ſides of the true Sun, in the interſection of the *Firſt* and *Third* Circle, there was alſo upon the *Firſt* great Circle, a *third* Mock-ſun, ſituated to the *North*, which was leſs and leſs bright, than the two others. So that at the ſame time there were ſeen *Four* Suns in the heavens.

Figure II. will illuſtrate the Poſition of this *Phænomenon*.

A. *The Zenith or the Point Vertical of the place of Obſervation.*

R. *The true Sun.*

SCHN. *The great Circle, altogether White, almoſt parallel to the Horizon, which paſs'd through the True Sun's Diske, and upon which were the Falſe Suns.*

DEBO. *A Rain-bow about the Sun, forming an entire Circle, but interrupted in ſome places.*

HDN. *A portion of a Circle, that was Excentrick to the Sun, and greater than the Circle* DEBO, *which touch'd* DEBO, *and was confounded with it in the point* D.

HN. The

H N. *The two Mock-Suns, in the interſection of the Semicircle* H D N, *and the Circle* S C H N: *The midſt of which two Falſe-Suns was white and very luminous; and their Extreamities towards* D I *were tinged with the Colours of a Rainbow. The Falſe Sun, mark'd* N, *was fainter than that, which is mark'd* H.

C. *The Mock-Sun, all white, and far leſs ſhining, than the two others.*

I. *A ſpace very dark betwixt* R. *and* D.

This Appearance is look't upon as one of the notableſt, that can be ſeen, by reaſon of the *Excentricity* of the Circle H D N, and becauſe that the *Parhelia* * were not in the Interſection of the Circle D E B O with the great Circle S C H N, but in that of the Semi-circle H D N.

As for the two odd *Rainbows*; they appear'd at *Chartres* the 10. of *Auguſt*, 1665. about half an hour paſt ſix in the Evening; and did croſs one another almoſt at right Angles, as may be ſeen by *Fig.* I V.

The Rainbow, which was oppoſite to the Sun, in the uſual manner, was more deeply colour'd, than that, which croſs'd it; though even the Colours of the firſt *Iris* were not ſo ſtrong, as they are now and then ſeen at other times.

The greateſt height of the ſtronger Rainbow, was about 45. degrees; the feebler Rainbow loſt one of its Legs, by growing fainter, about 20. degrees above the ſtronger; and the Leg below appear'd continued to the *Horizon*.

Theſe Rainbows did not *Juſt* decuſſate one another at right Angles; there was ſome 6. or 7. degrees difference. The fainter, ſeem'd to be a Portion of a great Circle; and the ſtronger was but a Portion of a ſmall Circle, as uſually.

The Sun, at their appearance, was about 6. degrees high above the *Horizon*, and towards the 17. *Azimuth* of the Weſt, Northward.

The

* *Thoſe* Five *Suns, that appear'd the* 29 March, *A.* 1629. *at* Rome, *between* 2. *or* 3. *of the clock in the afternoon, were thus poſited; that the two of them, which were in the interſection of two Circles, appear'd in that of a Circle, which paſſed through the Suns Diske, with another, that was* Concentrick *to the Sun: as may be ſeen in* Figure III. *borrow'd (for the eaſier comparing them together) out of* Des-Cartes *his* Meteors, *cap. X.*

The Obſerver, M. *Eſtienne*, notes, that, when he made this Obſervation, the River of *Chartres*, which runs very near from *South* to *North*, was betwixt him and the Rainbow; and that he ſtood Level with this River, whence he was diſtant not above 150. paces: which he adds, that the Curious may the better judge of this Obſervation.

A Relation
Of an Accident by Thunder and Lightning, at Oxford.

This was imparted by Dr. *Wallis* in a Letter, written at *Oxford*, May 12. 1666. to the *Publiſher*, as follows:

I ſhould ſcarce have given you ſo ſoon the trouble of another Letter, were it not for an Accident which hapn'd here *May* 10. I had that afternoon, about 4. of the clock heard it thunder at ſome diſtance. About 5. of the clock the Thunder coming nearer to Us, it began to rain, and ſoon after (the rain withall increaſing) the Thunder grew very loud, and frequent, and with long ratling Claps (though not altogether ſo great, as I have ſome other times heard:) and the Lightning with flaſhes very bright (notwithſtanding the clear day-light) and very frequent, (when at the the faſteſt, ſcarce a full minute between one flaſh and another; many times not ſo much, but a ſecond flaſh before the Thunder of the former was heard:) The Thunder for the moſt part began to be heard about 8. or 10. ſecond minutes after the flaſh; as I obſerv'd for a great part of the time by my Minute-Watch: but once or twice I obſerv'd it to follow (in a manner) immediately upon it, as it were in the ſame moment; and the lightning extream red and fiery. I do not uſe to be much apprehenſive of Thunder and lightning, but I was at this time (I know not well, why?) very apprehenſive, more than ordinary, of miſchief to be done by it, for it ſeem'd to me to be very low and near Us (which made me ſo particular, as to obſerve the diſtance of the flaſh by the noiſe) and very frequent, and bright, ſo that, had it been by night as it was by day, it would have been very terrible. And, though I kept within doors, yet I ſenſibly diſcover'd a ſtinking ſulphureous ſmell in the Air. About 7. of the clock it ended, before which time I had news brought me of a Sad Accident upon the

water

water at *Medley* about a mile or ſomewhat more diſtant from hence. Two Schollars of *Wadham*-Colledge, being alone in a Boat (without a water-man) having newly thruſt off from ſhore, at *Medley*, to come homewards, ſtanding near the head of the boat, were preſently with a ſtroke of Thunder or Lightning, both ſtruck off out of the boat into the water, the one of them ſtark dead, in whom, though preſently taken out of the water, (having been by relation, ſcarce a minute in it) there was not diſcerned any appearance of life, ſenſe, or motion: the other was ſtuck faſt in the mud (with his feet downwards, and his upper parts above water) like a poſt not able to help himſelf out; but, beſides a preſent ſtonying or numneſs, had no other hurt; but was for the preſent ſo diſturb'd in his ſenſes, as that he knew not, how he came there out of the boat, nor could remember either thunder or lightning, that did effect it: and was very feeble and faint upon it; which (though preſently put into a warm bed) he had not throughly recover'd by the next night; and whether ſince he have or no, I know not.

Others in another boat, about 10 or 20 yards from theſe (as by their deſcription I eſtimate) felt a diſturbance and ſhaking in their boat, and one of them had his Chair ſtruck from under him, and thrown upon him; but had no hurt. Thoſe immediately made up to the others, and (ſome leaping into the water to them) preſently drew them either into the boat or on ſhore; yet none of them ſaw theſe two fall into the water (not looking that way) but heard one of them cry out for help preſently upon the ſtroke, and ſmelt a very ſtrange ſtinking ſmell in the Air; which, when I asked him, that told it me, what kind of ſtink? he ſaid, like ſuch a ſmell, as is perceived upon the ſtriking of Flints together.

He that was dead (when by putting into a warm bed, and rubbing, and putting ſtrong waters into his mouth, *&c.* no life could be brought into him) was the next morning brought to town; where, among multitudes of others, who came to ſee, Dr. *Willis*, Dr. *Mellington*, Dr. *Lower*, and my ſelf, with ſome others, went to view the Corps: where we found no wound at all in the skin; the face and neck ſwart and black, but not more, than might be ordinary, by the ſetling of the blood: On the right ſide of the neck was a little blackiſh ſpot about an inch long, and

about a quarter of an inch broad at the broadeſt, and was, as if it had been ſear'd with a hot iron; and, as I remember, one ſomewhat bigger on the left ſide of the neck, below the Ear. Streight down the breaſt, but towards the left ſide of it, was a large place about three quarters of a Foot in length, and about two inches in breadth, in ſome places more, in ſome leſs, which was burnt and hard, like Leather burnt with the fire, of a deep blackiſh red Colour, not much unlike the ſcorched skin of a roſted pig: And on the fore-part of the left ſhoulder ſuch another ſpot about as big as a ſhilling; but that in the neck was blacker and ſeem'd more ſear'd. From the top of the right ſhoulder, ſloping downwards towards that place in his breaſt, was a narrow Line of the like ſcorched skin; as if ſomewhat had come in there at the neck, and had run down to the breaſt, and there ſpread broader.

The buttons of his *Doublet* were moſt of them off; which, ſome thought might have been torn off with the blaſt, getting in at the neck; and then burſting its way out: for which the greateſt preſumption was (to me) that, beſides 4 or 5 buttons wanting towards the bottom of the breaſt, there were about half a dozen together clear off from the bottom of the collar downwards, and I do not remember, that the reſt of the buttons did ſeem to be near worn out, but almoſt new. The Collar of his doublet juſt over the forepart of the left ſhoulder was quite broken aſunder, cloth and ſtiffening, ſtreight downwards, as if cut or chop'd aſunder, but with a *Blunt* tool; onely the inward linnen or fuſtian lineing of it was whole, by which, and by the view of the ragged Edges, it ſeem'd manifeſt to me, that it was by a ſtroak inwards (from without) not outwards from within.

His *Hat* was ſtrangely torn, not juſt on the Crown, but on the ſide of the hat, and on the brim. On the ſide of it was a great hole, more than to put in ones fiſt through it: ſome part of it being quite ſtruck away, and from thence divers gaſhes every way, as if torn, or cut with a *Dull* tool, and ſome of them of a good length, almoſt quite to the edges of the brim. And, beſide theſe, one or two gaſhes more, which did not communicate with that hole in the ſide. This alſo I judged by a ſtroke inwards; not ſo much from the view of the edges of thoſe gaſhes (from which there was ſcarce any judgment to be made either way) but be-

cauſe

cauſe the lining was not torn, only ript offfrom the edge of the hat (where it was ſow'd on) on that ſide, where the hole was made. But his hat not being found upon his head, but at ſome diſtance from him, it did not appear, againſt what part of the head that hole was made.

Upon the reſt of his Cloaths, I do not know of any further effect; nor did we ſmell any ſulphurous ſcent about them: which might be, *Partly* becauſe it was now a good while after the time, and *Partly* by reaſon of their being preſently drenched in the water into which he fell.

The night following, the three *Doctors* above mentioned, & my ſelf, with ſome Chirurgions (beſides a multitude of others) were preſent at the opening of the head, to ſee if any thing could be there diſcover'd; but there appear'd no ſign of contuſion; the brain full and in good order; the nerves whole and ſound, the veſſels of the brain pretty full of blood. But nothing was by any of them diſcern'd to be at all amiſs. But it was by candle-light, and they had not time to make very nice Obſervation of it (the Body being to be buried by and by) and the crowd of people was a further hindrance. But if any thing had been conſiderably out of order to the view, it would ſurely have been by ſome of them diſcovered. Some of them thought, they diſcern'd a ſmall fiſſure or crack in the skull; and ſome who held it, while it was ſawing off, ſaid, they felt it Jarring in their hands, and there ſeem'd to the eye ſomething like it, but it was ſo ſmall, as that by Candle-light we could not agree it certainly ſo to be.

Some of the *Hair* on the right Temples was manifeſtly ſinged, or burnt; and the lower part of that Ear blacker, than the parts about it, but ſoft; and it might be only the ſetling of the Bloud. The upper part of the left ſhoulder, and that ſide of the neck, were alſo ſomewhat blacker, than the reſt of the Body, but whether it were by the blow, which broke the collar, and ſcorch'd the round red ſpot thereupon, or only by ſetling of the bloud, I cannot ſay; yet I think, it might very well be, that both on the head, and on this ſide of the neck, there might be a very great blow, and a contuſion upon it (and ſeems to have been ſo, by the tearing of the hat, and breaking the collar, if not alſo cracking of the skull) and yet no ſign of ſuch contuſion, becauſe dying ſo immediately, there was not time for the bloud to gather

to the part and ſtagnate there (which in bruiſes is the cauſe of blackneſs) and it was but as if ſuch a blow had been given on a Body newly dead; which does not uſe to cauſe ſuch a ſymptom of a bruiſe, after the bloud ceaſes to circulate.

Having done with the Head, they open'd the *Breaſt*, and found that burning to reach quite through the skin, which was in thoſe ſcorch'd places hard and horney, and ſhrunk up, ſo as it was not ſo thick as the ſoft skin about it: but no appearance of any thing deeper than the skin; the Muſcles not at all diſorder'd or diſcolour'd (perhaps, upon the reaſon, that was but now ſaid of the Head, Neck and Shoulder.) Having then taken off the *Sternum*, the Lungs and Heart appear'd all well, and well-coloured without any diſorder.

This is the ſum of what was obſerved; onely that the whole Body was, by night, very much ſwell'd, more than in the morning; and ſmelt very ſtrong and offenſively: Which might be by the hotneſs of the weather, and by the heat of the place occaſion'd by the multitude of people.

An Experiment
To examine, what Figure, *and* Celerity *of* Motion *begetteth, or encreaſeth* Light *and* Flame.

This was communicated by Dr. *Beale*, as follows;

May 5. 1665. freſh Mackrels were boyl'd in Water, with ſalt and ſweet herbs; and, when the Water was perfectly cold, the next morning, the Mackrels were left in the Water for pickle.

May 6. more freſh Mackrels were boyl'd in like water; and *May* 7. both water and Mackrels were put into the former water, together with the former Mackrels. (Which circumſtances I do particularize, becauſe, whether, the mixture of the pickle of ſeveral ages, and a certain ſpace of time, or whatever elſe was neceſſary, and wanting, the tryal did not ſucceed with like effect at other times.)

But now on the next Munday (*May* 8.) evening, the Cook ſtirring the water, to take out ſome of the Mackrels, found the water at the firſt motion become very luminous, and the Fiſh ſhining through the water, as adding much to the Light, which the water yielded. The water by the mixture of Salt and Herbs,

in

in the boyling, was of it ſelf thick and rather blackiſh, than of anyo ther clear colour: yet being ſtirr'd, it ſhin'd, and all the fiſh appear'd, more brightly luminous in their own ſhapes.

Wherever the drops of this water (after it was ſtirr'd) fell on the ground, or benches, they ſhin'd: And the children took drops in their hands, as broad as a penny, running with them about the houſe, and each drop, both neer and at diſtanee, ſeem'd by their ſhining as broad as a ſix pence, or a ſhilling, or broader.

The Cook turn'd up the ſide of the fiſh, which was loweſt, and thence came no ſhining: and after the water was for ſome good time ſetled, and fully at reſt, it did not ſhine at all.

On Tueſday night (*May* 9.) we repeated the ſame Trial, and found the ſame effects. The water, till it was ſtirr'd, gave no light, but was thick and dark, as we ſaw by day-light, and by candle-light. As ſoon as the Cooks hand was thruſt into the water, it began to have a glimmering; but being gently ſtirr'd by the hand moving round (as the Dairy-maids do to gather the Curds for Cheeſe) it did ſo ſhine, that they, who look'd on it at ſome diſtance, from the further end of another room, thought verily, it was the ſhining of the Moon through a Window upon a Veſſel of Milk; and by briſker Circulation it ſeem'd to flame.

The Fiſh did then ſhine as well from the Inſide, as the Outſide, and chiefly from the throat, and ſuch places, as ſeem'd a little broken in the boyling.

I took a piece, that ſhin'd moſt, and fitted it, as well as I could deviſe in the night, both to my great *Microſcope*, and afterwards to my little one; but I could diſcern no light by any of theſe Glaſſes; nor from any drops of the ſhining water, when put into the Glaſſes. And *May* 10. in the brighteſt rayes of the Sun, I examin'd, in my great *Microſcope*, a ſmall broken piece of the Fiſh, which ſhin'd moſt the night before. We could find nothing on the ſurface of the Fiſh very remarkable. It ſeem'd whitiſh, and in a manner dried, with deep inequalities. And others, as well as my ſelf, thought, we ſaw a ſtream, rather darkiſh, than luminous, ariſing, like a very ſmall duſt, from the fiſh: And rarely here and there, a very ſmall, and almoſt imperceptible ſparkle in the Fiſh. Yet of theſe *ſparkles* we are *certain*; we numbred them, and agreed in the number, order and place. Of the *ſteam* I am not confident, but do ſuſpect our Eyes in the bright

bright Sun, or that it might be ſome duſt in the Aire.

The great *Microſcope* being fitted in the day-light for this piece of Fiſh, we examin'd it that night, and it yielded no light at all, either by the view of the Glaſs, or otherwiſe.

Finding it dry, I thought that the moiſture of Spittle, and touching of it, might cauſe it to ſhine: and ſo it did, though but a very little, in a few ſmall ſparks, which ſoon extingniſh't. This we ſaw with the bare eye; not in the Glaſs.

The Fiſh were not yet fetide, nor inſipid to the beſt diſcerning palats: And I cauſed two Fiſh to be kept for further Tryall, two or three daies longer, till they were fetide in very hot weather; and then I expected more brightneſs, but could find none, either in the water, by ſtirring it, or in the Fiſh, taken out of the water.

And ſome Trials I made afterwards with other boyld Mackrels (as is aboveſaid) with like pickle, but fail'd of the like ſucceſs.

This ſeaſon ſerves for many Trials in this kind, and by better *Microſcopes*, or better ordered. And in theſe Vulgarities we may perhaps as well trace out the cauſe and nature of Light, as in Jewels of greateſt value, *&c.*

Some Conſiderations
Touching a Letter in the Journal des Scavans *of* May 24. 1666.

In *Num.* 9. of theſe *Tranſactions* were publiſh't the *Schemes* and *Deſcriptions* of certain Waies of *Sounding the Depth of the Sea without a Line*; and of *Fetching up Water from the bottom of it*; together with ſome Experiments already made with the former of theſe two Contrivances. The Author of the French *Journal des Scavans* found good, to inſert them both in his *Journal* of *May* 3; but in another of *May* 24. intimates, that the ſaid *Schemes* and their *Deſcriptions* are not very clear and intelligible (he means, that they were not well underſtood by *French* Readers;) propoſing alſo ſome Difficulties, relating to that Subject, and eſteemed by him neceſſary to be ſatisfied, before any uſe could be made of the ſaid Inſtruments.

Upon this occaſion, the Author of theſe *Tracts* thinks fit, here to repreſent,

Firſt,

First, That *Engliſh*-men and ſuch others, as are well verſed in the *Engliſh* tongue, find no difficulty in underſtanding the deſcriptions of theſe *Engins*, nor in apprehending their ſtructnre, exhibited by the *Figures*, eſpecially if notice be taken of the Emendation, expreſſed at the end of *Num.* 10. about the miſgraving the *Bended end* of the *Springing Wire*; (which it ſeems has not been noted in *France*, though the ſaid *Num.* 10. is known to have been ſeen there a pretty while before their *Journal* of *May* 24. was publiſh't.) And as for the particular of the *Bucket*, fetching water from the bottom of the Sea, both the *Figure* and the annexed *Deſcription* thereof are ſo plain and clear, that 'tis ſome wonder here, that any difficulty of underſtanding them is pretended by any, that hath but ordinary skill in *Cutts* and the *Engliſh* language. Mean while, that way, which the *French* Author recommends for this purpoſe as more ſimple, *Videl. a Braſs-Pump with double Valves*, is not at all unknown in *England*, nor has bin left untried there; but was found inconvenient, in reſpect that the Valves in deſcending did not fully open, and give the water a free paſſage through the Cavity of the Veſſel, nor in aſcending ſhut ſo cloſe, as to hinder the water from coming in at the top: Whereas by the way, propoſed in *Num.* 9. both is perform'd with great eaſe and ſecurity.

Secondly, Whereas the *French* Author is of opinion, that 'tis unknown, How much time a Heavy Body requires to ſink in water, according to a certain depth; He may pleaſe to take notice, that that hath been made out in *England* by frequent Experiments; by which, ſeveral Depths, found by this Method of ſounding *without* a Line, were examin'd by trying them over again in *the ſame* place *with* a Line, after the common way. And as to that *Quære* of his, Whether a heavy Body deſcends in the ſame *Proportion* of ſwiftneſs in *Water*, that it would do in *Air*? The anſwer is, that it does not; but that, after it is ſunk one or two fathoms into the Water, it has there arrived to its greateſt ſwiftneſs, and keeps, after that, an equal degree of velocity; the *Reſiſtance* of the water being then found equal to the *Endeavour* of the heavy Body downwards.

Thirdly, When the ſame *Author* alledges that it muſt be known, when a Light Body reaſcends from the bottom of the water to the

the top, in what proportion of time and ſwiftneſs it riſes. He ſeems not to have conſider'd, that in this Experiment, the times of the deſcent and aſſent are both taken and computed together; ſo that, for this purpoſe, there needs not that nicety, he diſcourſes of.

Fourthly, Whereas 'tis further excepted, That this way of Sounding depths is no new invention; The anſwer is ready, that neither is it pretended to be ſo, in the often quoted *Tract*; it being only intimated there, that the manner of performing it, as 'tis in that place repreſented and deſcribed, is new.

Laſtly, To rectifie the ſaid Author's miſtake, as if the inſtrument of Fetching up water from the bottom of the Sea, were chiefly contriv'd, to find out, Whether in ſome places of the ſea any *Sweet* water is to be met with at the bottom: There will need no more, than to direct him to the Book it ſelf *Num.* 9. where p. 149. towards the end, the *Firſt* uſe of this *Bucket* is expreſſ'd to be, to know the *degrees of Saltneſs* of the water according to its nearneſs to the top or bottom; or rather to know the conſtitution of the Sea-water in ſeveral depths of ſeveral *Climats*, which is a matter, much better to be found out by *Triall*, than *Diſcourſe*. Neither is it any where argued in that Book (as the *French Iournal* inſinuates) that, becauſe ſweet water is found at the bottom of the Sea of *Baharem*, therefore it *muſt*; but only that it *may*, be found ſo elſewhere. And ſince the ſame *Iournal* admits, that thoſe Sweet water-ſprings, which yield the ſweet water, that is found at the ſaid place, have been formerly on the *Continent*, far enough from the ſea, which hath afterwards cover'd them; It will be, 'tis preſum'd, lawful to ask, Why in many other places there may not be found the like? And beſides, how we do know, but that there may be in other parts, Eruptions of large ſprings at the bottom of the Sea, as well as there.

Printed with Licence for *John Martyn*, and *James Alleſtry*,
Printers to the Royal Society. 1666.

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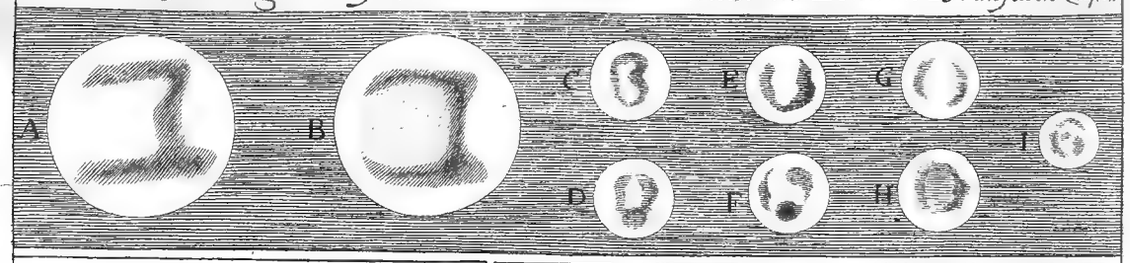
The Figures of the Obseruations made in London — *Transact: N 14th*



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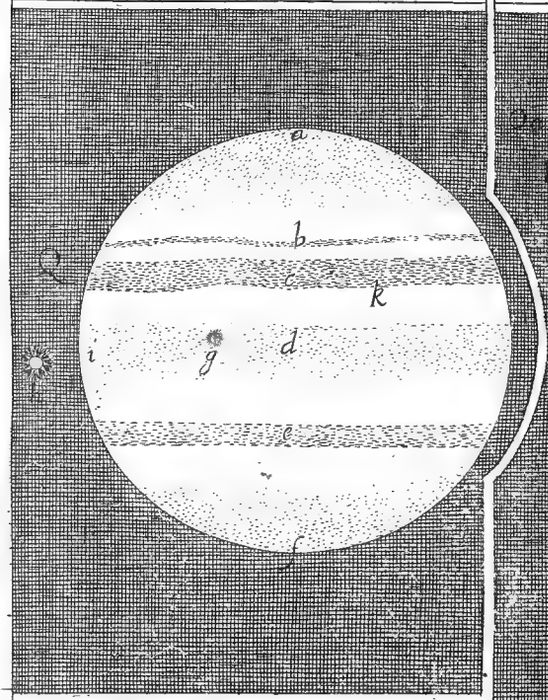

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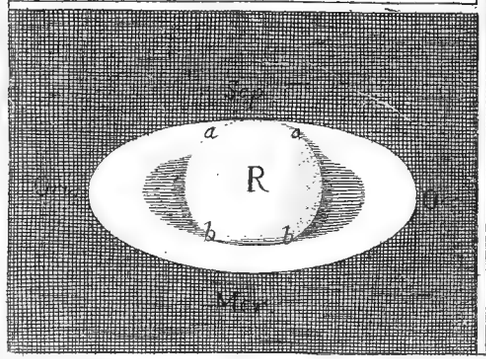

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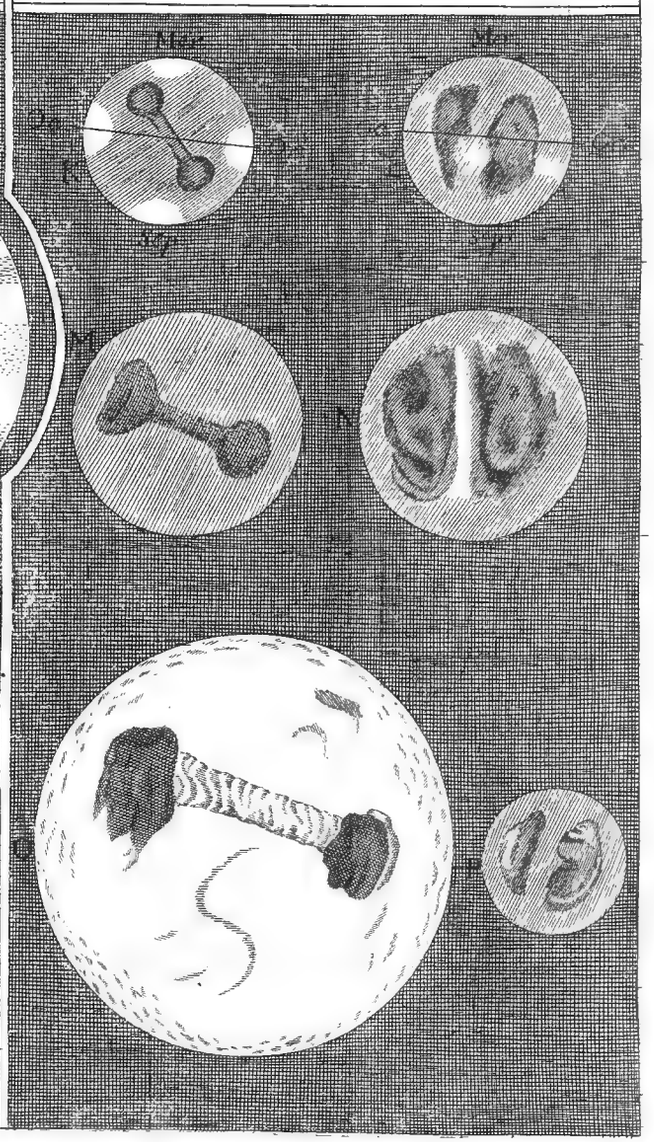

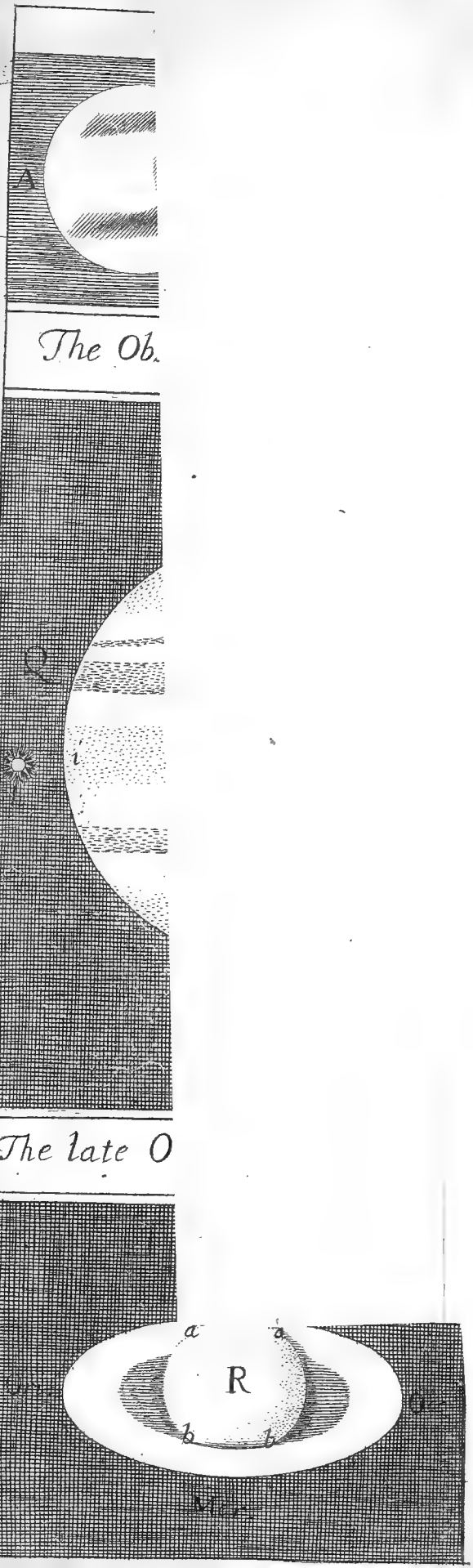
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PHILOSOPHICAL TRANSACTIONS.

Munday, July 2. 1666.

The Contents.

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An Account

Of a New *kind of* Baroſcope, *which may be called* Statical; *and of ſome Advantages and Conveniencies it hath above the* Mercurial: *Communicated, ſome while ſince, by the Honourable* Robert Boyle.

AS for the *New* kind of *Baroſcopes*, which, not long agoe, * I intimated to you, that my haſte would not permit me to give you an account off; ſince your Letters acquaint me, that you ſtill deſign a Communicating to the

* See *Num.* 11. p. 185. *Phil. Tranſactions.*

Curious as much Information, as may be, in reference to *Baroſcopes*; I ſhall venture to ſend you ſome Account of what I did but name (in my former Letter) to you.

Though by a Paſſage, you may meet with in the 19th and 20th Pages of my *Thermometrical Experiments and Thoughts*, you may find, that I did ſome years agoe think upon this New kind of Baroſcope; yet the Changes of the Atmoſphere's Weight not happening to be then ſuch, as I wiſh'd, and being unwilling to deprive my ſelf of all other uſe of the exacteſt Ballance *, that I (or perhaps any man) ever had, I confeſs to you, that ſucceſſive avocations put this attempt for two or three years out of my thoughts; till afterwards returning to a place, where I chanc'd to find two or three pairs of Scales, I had left there, the ſight of them brought it into my mind; and though I were then unable to procure exacter, yet my deſire to make the Experiment ſome amends for ſo long a neglect, put me upon conſidering, that if I provided a *Glaſs-buble*, more than ordinary large and light, even ſuch Ballances, as thoſe, might in ſome meaſure perform, what I had tried with the ſtrangely nice ones above-mention'd.

* *The* Scales *here meant were before competent Eye-witneſſes made to turn manifeſtly with the thouſandth part of a grain.*

I cauſed then to be blown at the Flame of a Lamp ſome *Glaſs-bubles* as large, thin and light, as I could then procure, and chooſing among them one, that ſeem'd the leaſt unfit for my turn, I counterpoiſed it in a pair of Scales, that would looſe their *Æquilibrium* with about the 30th part of a Grain, and were ſuſpended at a Frame. I placed both the Ballance and the Frame by a good Baroſcope, from whence I might learn the preſent weight of the Atmoſphere. Then leaving theſe Inſtruments together; though the Scales, being no nicer than I have expreſs'd, were not able to ſhew me all the Variations of the Air's weight, that appear'd in the *Mercurial* Baroſcope, yet they did what I expected, by ſhewing me variations no greater, than alter'd the height of Quickſilver half a quarter of an Inch, and perhaps much ſmaller, than thoſe: Nor did I doubt, that, if I had had either tender Scales, or the means of ſupplying the Experiment with convenient accommodations, I ſhould have diſcerned

ſcerned far ſmaller Alterations of the Weight of the Air, ſince I had the pleaſure to ſee the Buble ſometimes in an *æquilibrium* with the counterpoiſe; ſometimes, when the Atmoſphere was high, preponderate ſo manifeſtly, that the Scales being gently ſtirr'd, the Cock would play altogether on that ſide, at which the Buble was hung; and at other times (when the Air was heavier) that, which was at the firſt but the Counterpoiſe, would preponderate, and, upon the motion of the Ballance, make the Cock vibrate altogether on its ſide. And this would continue ſometimes many daies together, if the Air ſo long retain'd the ſame meaſure of gravity; and then (upon other changes) the Buble would regain an *æquilibrium*, or a preponderance; ſo that I had oftentimes the ſatisfaction, by looking firſt upon the *Statical* Baroſcope (as for diſtinctions ſake it may be call'd) to foretell, whether in the *Mercurial* Baroſcope the Liquor were high or low. Which Obſervations though they hold as well in Winter, and ſeveral times in Summer (for I was often abſent during that ſeaſon) as the Spring, yet the frequency of their Viciſſitudes (which perhaps was but accidental) made them more pleaſant in the latter of theſe ſeaſons.

So that, the matter of Fact having been made out by variety of repeated Obſervations, and by ſometimes comparing ſeverall of thoſe new *Baroſcopes* together, I ſhall add ſome of theſe Notes about this Inſtrument, which readily occur to my memory, reſerving the reſt till another opportunity.

And *Firſt*, if the ground, on which I went in framing this *Baroſcope*, be demanded, the anſwer in ſhort may be; 1. That, though the Glaſs-buble, and the Glaſs-counterpoiſe, at the time of their firſt being weigh'd, be in the Air, wherein they both are weigh'd, exactly of the ſame weight; yet they are nothing near of the ſame bulk; the Buble, by reaſon of its capacious cavity (which contains nothing but Air, or ſomething that weighs leſs than Air) being perhaps a hundred or two hundred times (for I have not conveniency to meaſure them) bigger than the Metalline counterpoiſe. 2. That according to a *Hydroſtatical* Law (which you know I have lately had occaſion to make out) If two Bodies of equal gravity, but unequal bulk come to be weigh'd in another *Medium*, they will be no longer

equiponderant; but if the new *Medium* be heavier, the greater Body, as being lighter in *Specie*, will looſe more of its weight, than the leſſer and more compact; but if the new *Medium* be lighter than the firſt, then the bigger Body will outweigh the leſſer: And this diſparity, ariſing from the change of *Medium*'s, will be ſo much the greater, by how much the greater inequality of bulk there is between the Bodies formerly equiponderant. 3. That, laying theſe two together, I conſider'd, that 'twould be all one, as to the effect to be produced, whether the Bodies were weighed in *Medium*'s of differing gravity, or in the ſame *Medium*, in caſe its (*ſpecifick*) gravity were conſiderably alter'd: And conſequently, that ſince it appear'd by the *Baroſcope*, that the weight of the Air was ſometimes heavier, and ſometimes lighter, the alterations of it, in point of gravity, from the weight, it was off at firſt counterpoiſing of the Buble of it, would *unequally* affect ſo large and hollow a Body, as the Buble, and ſo ſmall and denſe a one, as a Metallin weight: And when the Air by an increaſe of gravity ſhould become a heavier *Medium*, than before, it would buoy up the Glaſs more than the Counterpoiſe; and if it grew lighter, than it was at firſt, would ſuffer the former to preponderate: (The Illuſtrations and Proof can ſcarce be added in few words; but, if it be deſired, I may, God permitting, ſend you them at my next leaſure:) And though our Engliſh Air be about a thouſand times lighter, than water, the difference in weight of ſo little Air, as is but equal in bulk to a Buble, ſeem'd to give ſmall hopes, that it would be ſenſible upon a Ballance; yet, by making the Buble very large and light, I ſuppoſed and found the Event, I have already related.

Secondly, The hermetically ſeal'd Glaſs-buble, I employed, was of the bigneſs of a ſomewhat large *Orange*, and weigh'd about 1. drachme and 10. grains. But I thought it very poſſible, if I had been better furniſh't with conveniencies (wherein I afterwards found, I was not miſtaken) to make (among many, that might be expected to miſcarry) ſome, that might be preferable to this, either for capacity or lightnes, or both; eſpecially if care be taken, that they be not ſeal'd up, whilſt they are too hot. For, though one would think, that it were advantagious

tagious to rarify and drive out the Air as much as is poſſible, becauſe in ſuch ſeal'd Bubles the Air it ſelf (as I have elſewhere ſhewn) has a weight; yet this advantage countervails not the inconvenience of being obliged to increaſe the weight of the Glaſs, which when it includes highly rarified Air, if it be not ſomewhat ſtrong, will be broken by the preſſure of the External Air, as I have ſufficiently tryed.

Thirdly, I would have tryed, whether the *Dryneſs* and *Moiſture* of the Air would in any meaſure have alter'd the weight of the Buble, as well as the Variation of Gravity produced in the *Atmoſphere* by other cauſes; but the extraordinarily conſtant abſence of Fogs, kept me from making Obſervations of this kind; ſave that one morning early, being told of a miſt, I ſent to ſee (being my ſelf in bed) whether it made the Air ſo heavy as to buoy up the Buble; but did not learn, that that miſt had any ſenſible operation on it.

Fourthly, By reaſon of the difficulties and caſualties, that may happen about the procuring and preſerving ſuch large and light Bubles, as I have been lately mentioning; it may in ſome caſes prove a convenience to be inform'd, That I have ſometimes, inſtead of one ſufficiently large Buble, made uſe of two, that were ſmaller. And, though a ſingle Buble of competent bignes be much preferable, by reaſon that a far leſs quantity and weight of Glaſs is requiſite to compriſe an equal capacity, when the Glaſs is blown into a ſingle Buble, than when it is divided into two; yet I found, that the employing of two inſtead of one, did not ſo ill anſwer my exſpectations, but that they may for a need ſerve the turn inſtead of the other; than which they are more eaſier to be procured: And if the Ballance be ſtrong enough to bear ſo much Glaſs, without being injur'd: by employing two or a greater number of large Bubles, the effect may be more conſpicuous, than if only a ſingle Buble (though a very good one) were employed.

This inſtrument may be much improved by divers Accommodations. As

Firſt, There may be fitted to the *Anſa* (or Checks of the Ballance) an Arch (of a Circle) divided into 19. or 20. deg. (more or leſs, according to the goodneſs of the Ballance) that the Cock reſting over againſt theſe Diviſions, may readily and

and without Calculation ſhew the quantity of the Angle, by which, when the ſcales propend either way, the Cock declines from the Perpendicular, and the beam from its Horizontall paralleliſm.

Secondly, Thoſe, that will be ſo curious, may, inſtead of the Ordinary Counterpoiſe (of Braſs) employ one of Gold, or at leaſt of Lead, whereof the *latter* being of equal weight with Braſs, is much leſs in Bulk, and the *former* amounts not to half its bigneſs.

Thirdly, Theſe parts of the Ballance, that may be made of Copper or Braſs, without any prejudice to the exactneſs, will, by being made of one of thoſe Mettals, be leſs ſubject, than Steel, (which yet, if well hardned and poliſh'd, may laſt good a great while) to ruſt with long ſtanding.

Fourthly, Inſtead of the ſcales, the Buble may be hung at one end of the Beam, and only a Counterpoiſe to it at the other, that the Beam may not be burthen'd with unneceſſary weight.

Fifthly, The whole inſtrument, if placed in a ſmall Frame, like a ſquare Lanthorn with Glaſs-windows, and a hole at the top for the Commerce of the internal and external Air, will be more free from duſt, aud irregular agitations; to the latter of which, it will otherwiſe be ſometimes incident.

Sixthly, This inſtrument being accommodated with a light Wheele and an Index (ſuch as have been applyed by the excellent Dr. *Chr. Wren* to open Weather glaſſes, and by the ingenious Mr. *Hook* to *Baroſcopes*) may be made to ſhew much more minute variations, than otherwiſe.

Seventhly, And the length of the Beam, and exquiſitneſs of the Ballance, may eaſily, *without* any of the foregoing helps (and much more *with* them) make the inſtrument far exacter, than any of thoſe, I was reduced to employ. And to theſe Accommodations divers others may be ſuggeſted by a farther conſideration of the nature of the thing, and a longer practice.

Though in ſome reſpects this *Statical* Baroſcope be inferior to the *Mercurial*; yet in others it has its own advantages and conveniencies above it.

And 1. It confirms *ad oculum* our former Doctrine, that the falling and riſing of the *Mercury* depends upon the varying weight of the Atmoſphere; ſince in this Baroſcope it cannot be

be pretended, that a *Fuga vacui*, or a *Funiculus*, is the cauſe of the changes, we obſerve. 2. It ſhews, that not only the Air has weight, but a more conſiderable one, than ſome Learned men, who will allow me to have prov'd, it has ſome weight, will admit; ſince even the variation of weight in ſo ſmall a quantity of Air, as is but equal in bulk to an *Orange*, is manifeſtly diſcoverable upon ſuch Ballances, as are none of the niceſt. 3. This *Statical* Baroſcope will oftentimes be more parable, than the other: For many will finde it more eaſie, to procure a good pair of Gold-ſcales, and a Buble or two, than a long Cane ſeal'd, a quantity of *Quick-ſilver*, and all the other requiſits of the *Mercurial* Baroſcope; eſpecially if we compriſe the trouble and skill, that is requiſite to free the deſerted part of the Tube from Air. 4. And whereas the difficulty of removing the *Mercurial* Inſtrument has kept men from ſo much as attempting to do it, even to neighbouring places; the Eſſential parts of the *Scale*-Baroſcope (for the Frame is none of them) may very eaſily in a little room be carried, whither one will, without the hazard of being ſpoil'd or injur'd. 5. There is not in *Statical* Baroſcopes, as in the other, a danger of uncertainty, as to the goodneſs of the Inſtruments, by reaſon, that in *theſe* the Air is, in ſome more, and in ſome leſs perfectly excluded; whereas in *thoſe*, that conſideration has no place. (And by the way, I have ſometimes, upon this account, been able to diſcover by our new Baroſcope, that an eſteem'd *Mercurial* one, to which I compared it, was not well freed from Air.) 6. It being, as I formerly intimated, very poſſible to diſcover *Hydroſtatically*, both the bigneſs of the Buble, and the Contents of the cavity, and the weight and dimenſions of the Glaſſie ſubſtance (which together with the included Air make up the Buble,) much may be diſcover'd by this Inſtrument, as to the Weight of the Air, *abſolute* or *reſpective*. For, when the *Mercury* in the *Mercurial* Baroſcope is either very high, or very low, or at a middle ſtation between its greateſt and leaſt height, bringing the *Scale*-Barometer to an Exact *Æquilibrium*; (with very minute diviſions of a Graine,) you may, by watchfully obſerving, when the *Mercury* is riſen or faln juſt an inch, or a fourth, or half an inch *&c.* and putting in the like minute diviſions of a Grain to the lighter Scale, till you have again brought the Ballance to an exquiſite

exquisit *Æquilibrium*; you may, I say, determine, What known weight in the *Statical* Baroscope answers such determinate Altitudes of the ascending and descending Quick-silver in the *Mercurial*. And if the Ballance be accommodated with a divided Arch, or a Wheel and Index, these Observations will assist you for the future to determine readily, by seeing the inclination of the Cock or the degree mark'd by the Index, what pollency the Buble hath, by the change of the *Atmospheres* weight, acquired or lost. Some Observations of this nature I watchfully made, sometimes putting in a 64th. sometimes a 32th sometimes a 16th. and sometimes heavier parts of a Grain, to the lighter Scale. But one, that knew not, for what uses those little papers were, coming to a window, where my Baroscopes stood, so unluckily shook them out of the Scales, and confounded them, that he robb'd me of the opportunity of making the nice Observations I intended, though I had the satisfaction of seeing, that they were to be made. 7. By this *Statical* Instrument we may be assisted to compare the *Mercurial* Baroscopes of *several* places (though never so distant) and to make some Estimates of the Gravities of the Air therein. As if, for instance, I have found by Observation, that the Buble, I employ, (and one may have divers Bubles of several sizes, that the one may repaire any mischance, that may happen to another) weigh'd just a Drachme, when the *Mercurial* Cylinder was at the height of $29\frac{1}{2}$ inches (which in some places I have found a *moderate* altitude;) and that the Addition of the 16th part of a gr. is requisite to keep the Buble in an *Æquilibrium*, when the *Mercury* is risen an 8th, or any determinate part of an inch above the former station: When I come to another place, where there is a *Mercurial* Barometer, as well freed from Air as mine (for that must be supposed) if taking out my *Scale* instrument, it appeare to weigh precisely a Drachme, and the *Mercury* in the Baroscope there stand at just $29\frac{1}{2}$ inches, we may conclude the Gravity of the Atmosphere not to be sensibly unequal in both those two places, though very distant. And though there be no Baroscope there, yet if there be an additional weight, as for instance, the 16th part of a Grain requisite to be added to the Buble, to bring the scales to an *Æquilibrium*, it will appear that the Air at this second place is, at that time so

ſo much heavier, than the Air of the former place was, when the *Mercury* ſtood at 29½ inches.

But in making ſuch compariſons, we muſt not forget to conſider the Situation of the ſeveral places, if we mean to make Eſtimates not only of the weight of the Atmoſphere, but of the weight and denſity of the Air. For, though the Scales wil ſhew (as has been ſaid) whether there be a difference of weight in the Atmoſphere at the two places; yet, if one of them be in a Vale or bottom, and the other on the top or ſome elevated part of a Hill, it is not to be exſpected, that the Atmoſphere, in this latter place, ſhould gravitate as much, as the Atmoſphere in the former, on which a longer Pillar of Air does lean or weigh.

And the mention, I have made of the differing Situation of Places, puts me in mind of ſomething, that may prove another uſe of our *Statical* Baroſcope, and which I had thoughts of making tryal off, but was Accidentally hindred from the opportunity of doing it. Namely, that by exactly poyſing the Buble at the foot of a high Steeple or Hill, and carrying it in its cloſe Frame to the top, one may, by the weight requiſite to be added to Counterpoiſe there to bring the Beam to its Horizontal poſition, obſerve the difference of the weight of the Air at the bottom, and at the top; and, in caſe the Hill be high enough, at ſome intermediate Stations. But how far this may aſſiſt men, to eſtimate the *Abſolute* or *Comparative* height of Mountains, and other elevated Places; and what other Uſes the Inſtrument may be put to, when it is duly improved; and the Cautions, that may be requiſite in the ſeveral caſes, that ſhall be propoſed, I muſt leave to more leaſure, and farther Conſideration.

The Particulars.

Of thoſe Obſervations of the Planet Mars, *formerly intimated to have been made at* London *in the Months of* February *and* March *A.* 166⅝.

To perform, what was promiſed *Num.* 11. of theſe Papers, *pag.* 198; 'tis thought fit now to publiſh the Particular Obſervations, concerning the ſpots in *Mars*, and their motion, as they were made with a 36 foot Teleſcope, and produced in

writing before the *Royal Society*, the 28 *March* 1666. by Mr. *Hook*, as follows;

Having a great desire (saith he) to observe the *Body* of *Mars*, whilst *Acronycal* and *Retrograde* (having formerly with a Glass of about 12. foot long, observ'd some kind of Spots in the Face of it,) though it be not at present in the *Perihelium* of its Orbe, but nearer its *Aphelium*, yet I found, that the Face of it, when neer its Opposition to the Sun (with a Charge, the 36. foot-glass, I made use off, would well bear) appear'd very near as big, as that of the Moon to the *naked* eye; which I found, by comparing it with the Full Moon, near adjoyning to it, *March* 10.

But such had been the ill disposition of the Air for several nights, that from more than 20. Observations of it, which I had made since its being *Retrograde*, I could find nothing of satisfaction, though I often imagin'd, I saw Spots, yet the *Inflective veins* of the Air (if I may so call those parts, which, being interspers'd up and down in it, have a greater or less Refractive power, than the Air next adjoyning, with which they are mixt) did make it so confus'd and glaring, that I could not conclude upon any thing.

On the third of *March*, though the Air were still bad enough yet I could see now and then the Body of *Mars* appearing of the form A: which I presently described by a *Scheme*; and about 10. minutes after, as exactly representing what I saw through the Glass, as I could, I drew the *Scheme* B. This I was sufficiently satisfied (by very often observing it through the Tube, and changing my Eye into various positions, that so there might be no kind of Fallacy in it) could be nothing else, but some more *Dusky* and *Spotted* parts of the Face of this Planet.

March 10. finding the Air very bad, I made use of a very shallow Eye-glass, as finding nothing *Distinct* with the greater *Charge*; and saw the appearance of it as in C, which I imagin'd, might be the Representation of the former Spots by a lesser charge. About 3 of the Clock the same morning, the Air being *very bad* (though to appearance *exceeding clear*, and causing all the Stars to twinckle, and the minute Stars to appear very thick) the Body seem'd like *D*; which I still suppos'd to be the

the Repreſentation of the ſame Spots through a more confuſed and glaring Air.

But obſerving *March* 21. I was ſurpriſed to find the Air (though not ſo clear, as to the appearance of ſmall Stars) ſo *exceeding tranſparent*, and the Face of *Mars* ſo very well *defined*, and round, and diſtinct, that I could manifeſtly ſee it of the ſhape in E. about half an hour after Nine at night. The *Triangular* ſpot on the right ſide (as it was inverted by the Teleſcope, according to the appearances, through with all the preceeding *Figures* are drawn) appear'd very black and diſtinct, the other towards the left more dim; but both of them ſufficiently plain and defin'd. About a quarter before 12. of the Clock the ſame night, I obſerv'd it again with the ſame Glaſs, and found the appearance exactly, as in F; which I imagin'd to ſhew me a *Motion* of the former triangular ſpot: But deſigning to obſerve it again about 3. of the Clock the ſame Morning, I was hindred by cloudy weather.

But *March* 22. about half an hour after 8. at night, finding the ſame Spots in the ſame poſture, I concluded, that the preceeding Obſervation was only the appearance of the ſame Spots at another height and thickneſs of the Air: And thought my ſelf confirm'd in this Opinion, by finding them in much the ſame poſture, *March* 23. about half an hour after 9. though the Air was nothing ſo good as before.

And though I deſired to make Obſervations, about 3. of the Clock thoſe mornings; yet ſomething or other interven'd, that hindred me, till *March* 28. about 3 of the Clock, the Air being light (in weight) though moiſt and a little hazy; when I plainly ſaw it, to have the form, repreſented in I; which is not reconcileable with the other Appearances, unleſs we allow a *Turbinated* motion of *Mars* upon its Center: Which, if ſuch there be, from the Obſervations made *March* 21. 22. and 23. we may gueſs it to be once or twice in about 24. hours unleſs it may have ſome kind of *Librating* motion; which ſeems not ſo likely. Now, whether certainly ſo or not, I ſhall endeavour, as oft as I have opportunity, further to obſerve.

A particular direction to the *Figures* mentioned in the precedent diſcourſe.

A. *March* 3$^{d.}$ 00$^{h.}$ 20$^{m.}$ *in the morning: the Air having many inflec-*

ing parts diſperſed up and down in it; by the Wheel Barometer, *heavy,*

B. *Another Scheme, which I drew from my Obſervation, about* 10. *minutes after, the ſame morning. Both theſe were obſerved with a very deep Eye-glaſs.*

C. *March* 10$^{d.}$ 00$^{h.}$ 20$^{m.}$ *in the morning: the Air heavy and inflective. Uſe was made of a ſhallow or ordinary Charge.*

D. *March* 10$^{d.}$ 3$^{h.}$ 00^{m} *in the Morning; the Air very heavy and Inflective, which made it glare and radiate, and be more confuſed, than about* 3. *hours before. A ſhallow Charge.*

E. *March* 21$^{d.}$ 9$\frac{1}{2}^{h.}$ *poſt merid; the Air light (in weight) and clear, without inflecting parts; the Face appear'd moſt diſtinctly of this Forme. A ſhallow Charge.*

F. *March* 21$^{d.}$ 11$\frac{1}{4}^{h.}$ *poſt merid; the Air continuing very light and clear, without inflecting vapours. A ſhallow Charge.*

G. *March* 22$^{d.}$ 8$\frac{1}{2}^{h.}$ *poſt mer. the Air clear, with few inflecting veins in it, and indifferent light. A ſhallow Charge.*

H. *March* 23$^{d.}$ 9$\frac{1}{2}^{h.}$ *poſt mer. the Air pretty light, but moiſt, and ſomewhat thick and hazy, but ſeem'd to have but few veins, or inflecting parts.*

I. *March* 28$^{d.}$ 3$^{h.}$ *p. m. much the ſame kind of Air with that of March* 23; *light, moiſt, and a little hazy, with ſome very few veins.*

Obſervations

Made in Italy, *confirming the former, and withall fixing the* Period *of the Revolution of* Mars.

Theſe Obſervations we ſhall ſummarily preſent the Curious in theſe parts with, as they were lately preſented (by Letter from his Excellency the Ambaſſadour of *Venice*, now reſiding at the Court of *France*) to the *Royal Society*, in ſome printed ſheets of Paper, entituled, *MARTIS, circa Axem proprium Revolubilis, Obſervationes, BONONIÆ à Jo. DOMINICO CASSINO habitæ*; come to hand *June* 3. 1666.

In theſe Papers the Excellent *Caſſini* affirms;

1. That with a *Teleſcope* of 24. *Palmes*, or of about 16 *Foot*, wrought after S. *Campani's* way, he began to obſerve *February* 6. 1666 (ſt-n.) in the morning, and ſaw two dark Spots in the *firſt* Face of *Mars*.

2. That

2. That with the ſame Glaſs he obſerv'd *Febr.* $\frac{14}{24}$, in the Evening, in the *other* Face of this Planet, two other Spots, like thoſe of the firſt, but bigger.

3. That afterwards continuing the Obſervations, he found the Spots of theſe two Faces to turn by little and little from *Eaſt* to *Weſt*, and to return at laſt to the ſame ſituation, wherein he had ſeen them firſt.

4. That S. *Campani*, having alſo obſerv'd at *Rome* with Glaſſes of 50. *Palmes* or about 35 *Foot*, likewiſe of his own contrivance, had ſeen in the ſame Planet the ſame *Phenomena*.

4. That ſometimes he hath ſeen, during the ſame night, the two Faces of *Mars*, one, in the Evening, the other in the Morning.

6. That the Motion of theſe Spots in the inferior part of the apparent Hemiſphere of *Mars*, is made from *Eaſt* to *Weſt*, as that of all the other Celeſtial Bodies, and is perform'd by Parallels, that decline *much* from the *Equator*, and *little* from the *Ecliptick*.

7. That the Spots return the next day to the ſame ſituation, 40. minuts later, than the day before; ſo that in every 36. or 37. daies, about the ſame hour, they come again to the ſame place.

8. He promiſes ſhortly to give us the particular *Tables* of this Motion and of its Inequalities, together with the *Ephemerides* themſelves.

9. He repreſents, that ſome other *Aſtronomers* have alſo made at *Rome* ſeveral Obſervations of theſe Spots of *Mars*, from *March* $\frac{14}{24}$ to *March* $\frac{20}{30}$. with Glaſſes, wrought by *Euſtachio Divini*, of 25. and 45. Palmes: Which Spots he makes little differing from his own, of the firſt Face; as will by and by appear, by the direction to the *Schemes*.

10. But he adds, that thoſe other *Roman* Aſtronomers, that have obſerv'd with *Divini's* Glaſſes, will have the Converſion of *Mars* to be performed, not in 24 h, 40 *m*. (as he maintains it is) but in about 13 h.

11. And to evince, that they are miſtaken in theſe Obſervations of theirs; he alledges, That they aſſure that the Spots, which they have ſeen in this Planet, (by an *Euſtachian* Teleſcope) the $\frac{20}{30}$ of *March*, were ſmall, very diſtant from one another, remote from the middle of the Disk, and the *Oriental* Spot was leſs, than the *Occidental* (as is repreſented by the *Fig.* O; like that of the firſt Face of *Mars*.) whereas, on the contrary,

He:

He (*Caſſini*) pretends to evidence by his Obſervations, made at the ſame time at *Bononia*, that, the ſame day and hour, thoſe Spots were very large, neer one another, in the midſt of the Disk, the Oriental bigger than the Occidental (as appears by *Fig.* P, which is that of the ſecond Face of *Mars*.)

12. Beſides, he declares, that thoſe *Aſtronomers* were too haſty, in determining, after 5 or 6 Obſervations only, in how much time *Mars* finiſh's his Revolution; and denies it to be perform'd in 13 hours: adding, that, though Himſelf had obſerv'd for a much longer time, than they; yet he durſt not for a great while define, Whether *Mars* made but *one* Turn in 24 hours 40 minuts or *two*; and that all, that he could, for a long time affirm, was onely this, that after 24 h. 40 m. this Planet appear'd in the ſame manner he did before.

13. But ſince thoſe firſt Obſervations, He affirms to have found cauſe to determine, that the Period of this Converſion is made in the ſaid ſpace of 24 h. 40 m; and not oftner than once within that time; Alledging for proof;

1. That, whereas *Febr.* 6. (ſt.n.) he ſaw the Spots of the firſt Face of *Mars*, moving from eleven of the Clock in the night, until break of day, they appear'd not afterwards in the Evening after the riſing of that Planet (witneſs ſeveral intelligent perſons, which he names, that were preſent at the Obſervations) Whence he infers, that after 12 hours and 20 minuts, the ſame Spots did not come about; ſince that the ſame, which in the morning were ſeen in the middle, upon the riſing of *Mars*; after 13 or 14 hours, might have appear'd neer the Occidental Limb. But, becauſe he might be impoſed upon by Vapors, whilſt *Mars* was yet ſo neer the *Horizon*, he gives this other determination, *vid.*

2. Whereas he ſaw the firſt Face of *Mars* the 6 of *February* at 11 of the clock of the night following; he did not ſee the ſame after 18 daies at the ſame hour; as he ought to have done, if the Period were abſolved in the ſpace of 12 h. 20 m.

3. Again, whereas he ſaw *Febr.* 24. in the Evening, the other Face of *Mars*, he could not ſee the ſame, the 13. and 15. day of *March*, to wit after 17 and 19 days; as he ſhould have done, if the Revolution were made in the newly mention'd time.

4. Again, whereas the 27. of *March* in the Evening he ſaw the

the ſecond Face of *Mars*, he could not ſee it the 14. and 16. of *April*.

From all which Obſervations he Judges it to be evident, that the Period of this Planets Revolution is not perform'd in the ſpace of 12. hours 20, minutes, but in about 24 hours 40 minutes; more exactly to be determin'd by comparing diſtant Obſervations: And that thoſe who affirm the former, muſt have been deceived by not well diſtinguiſhing the two Faces, but that having ſeen the ſecond, taken it for the firſt.

All which he concludes with this Advertiſement, that, when he defines the time of the Revolution of *Mars*, he does not ſpeak of its *Mean* Revolution, but onely of that, which he obſerv'd, whilſt *Mars* was oppoſite to the Sun; which is the ſhorteſt of all.

The Figures of the Principal *Obſervations, repreſented in the Book here diſcourſed of, may be ſeen in the annexed* Scheme; videl.

K. *One of the Faces of* Mars, *as S.* Caſſini *obſerved it* March 3. (*ſt.n.*) 1666. *in the Evening, with a Glaſs of* 24 *Palmes.*

L. *The other Face, as he ſaw it* Febr. $\frac{14}{24}$ *in th Evening.*

M. *The firſt Face, as S.* Campani *ſaw at Rome,* March 3. 1666. *in the Evening, with a Glaſs of* 50 *Palmes.*

N. *The ſecond Face, as the ſame* Campani *obſerv'd it* March $\frac{18}{28}$. *in the Evening.*

O. *The Figure of* Mars, *as it was ſeen at* Rome *by a Teleſcope of* Divini *of* 45 *Palmes,* March $\frac{29}{30}$.

P. *The Figure of the ſaid Planet, as it was ſeen the ſame day and hour at Bononia by* Caſſini; *being that of the ſecond Face.*

Some Obſervations Lately made at London *concerning the Planet* Jupiter.

Theſe, as they were made, ſo they were imparted, by Mr. *Hook*, as follows:

A. 1666. *June* 26. between 3. and 4. of the Clock in the morning, I obſerved the Body of *Jupiter* through a 60. foot-glaſs, and found the apparent Diameter of it through the Tube, to be ſomewhat more than 2. degrees, that is, about four

times

times as big, as the Diameter of the *Moon* appears to the *naked* Eye. I ſaw the Limb pretty round, and very well defin'd without radiation. The parts of the *Phaſis* of it had various degrees of Light. About *a* and *f*, the *North* and *South* poles of it (in the *Fig.* Q.) 'twas ſomewhat darker, and by degrees it grew brighter towards *b*. and *e*, two Belts or Zones; the one of which (*b*) was a ſmall dark *Belt* croſſing the Body Southward; Adjoyning to which was a ſmal Line of a ſomewhat lighter part; and below that again, Southwards, was the great black *Belt c*. Between that, and *e*, the other ſmaller black Belt, was a pretty large and bright *Zone*; but the middle *d*, was ſomewhat darker than the edges. I perceiv'd, about $3^{h.}\,15^{m.}$ near the middle of this, a very *dark round Spot*, like that repreſented at *g*, which was not to be perceiv'd about half an hour before: And I obſerved it, in about 10. minutes time to be gotten almoſt to *d*, keeping equal diſtance from the *Satelles h*, which moved alſo Weſtwardly, and was joyn'd to the Disk at *i*, at $3^{h.}\,25^{m.}$ After which, the Air growing very hazy, and (as appeared by the *Baroſcope*) very light alſo (in weight) I could not obſerve it: So that it was ſufficiently evident, that this black Spot was nothing elſe, ſave the ſhadow of the *Satelles h*, Eclipſing a part of the Face of Jupiter. About two hours before, I had obſerved a large darker ſpot in the bigger *Belt* about *k*, which in about an hour or little more (for I did not exactly obſerve the time, nor draw the *Figure* of it) moving Weſtwards, diſappear'd. About a week before, I diſcover'd alſo, together with a Spot in the *Belt c*. another Spot in the *Belt e*, which kept the ſame way and velocity with that of the *Belt c*. The other three *Satellites* in the time of this Eclipſe, made by the *Satelles*, were Weſtwards of the Body of *Jupiter*; appearing as bright through the Tube, as the *Body* of *Jupiter* did to the naked Eye, and I was able to ſee them longer through the Tube, after the day-light came on, than I was able to ſee the *Body* of *Jupiter* with my naked eye.

A late Obſervation about Saturn *made by the ſame.*

June 29 1666. between 11. and 12. at night I obſerved the *Body* of *Saturn* through a 60. foot Teleſcope, and found it exactly

actly of the ſhape repreſented in the *Figure* R. The *Ring* appear'd of a ſomewhat brighter Light than the *Body*; and the black lines *a a*, croſſing the Ring, and *b b* croſſing the *Body* (whether Shadows or not, I diſpute not) were plainly viſible; whence I could manifectly ſee, that the *Souther*-moſt part of the Ring was on *this* ſide of the *Body*, and the *Northern* part, behind, or covered by the *Body*:

A Relation
Of a ſad effect of Thunder and Lightning:

This Relation was written by that worthy Gentleman, *Thomas Neale* Eſquire, (the then *High Sheriff* of the County of *Hampſhire*, when this diſaſter hapned) to a Friend of his in *London*, as follows;

On the 24 of *January* 166$\frac{5}{6}$, one Mr. *Brooks* of *Hampſhire*, going from *Wincheſter* towards his houſe near *Andover* in very bad Weather, was himſelf ſlain by Lightning, and the Horſe, he rode on, under him. For about a mile from *Wincheſter* he was found with his Face beaten into the ground, one leg in the ſtirrup, the other in the Horſes mane; his Cloaths all burnt off his back, not a piece as big as a handkerchief left intire, and his hair and all his body ſinged. With the force, that ſtruck him down, his noſe was beaten into his face, and his Chin into his *Breaſt*; where was a wound cut almoſt as low, as to his Navil; and his cloaths being, as aforeſaid, torn, the pieces were ſo ſcatter'd and conſum'd, that not enough to fill the crown of a hat could be found. His gloves were whole, but his hands in them ſing'd to the bone. The hip-bone and ſhoulder of his Horſe burn't and bruiſed; and his ſaddle torn in little pieces. This was what appear'd to the Coroners inqueſt, and ſo is likely to be as near truth, as any is to be had.

So *far this Letter*: Which, if it had come ſoon enough to the hands of the *Publiſher*, would have been joyned to a like *Relation*, inſerted in the next foregoing Papers (*Num.* 13.) of an accident hapn'd at a later time. With both which may be compared the Account, formerly publiſhed in Latin by the Learned Dr. *Charleton*, concerning the Boy, that was Thunder-

ſtruck near *Nantwich in Cheſhire*; the Title of the Book being, *Anatome Pueri de Cælo tacti*: ſuch Relations, when truly made, well deſerving to be carefully recorded for farther conſideration.

Of ſome Books lately publiſh't.

RELATIONS OF DIVERS CURIOUS VOYAGES, by *Monſ. Thevenot*, the third *Tome*, in *French*. This Book contains chiefly, the Ambaſſie of the *Dutch* into *China*, tranſlated out of the Dutch manuſcript: A Geographical deſcription of *China*, tranſlated out of a Chineſe Author by *Martinius*: And the Account, which the Directors of the Dutch Eaſt-India Company made to the States General, touching the ſtate of affairs in the Eaſt-Indies, when their late Fleet parted from thence. To touch ſome things of a *Geographical* and *Philoſophical* nature, contained therein, we ſhall take notice;

1. How the Kingdom of *China* is peopled; there being according to the beſt computation (which is there made with ſingular care) above 58 millions of Men, not counting Magiſtrates, Soldiers, Prieſts, Eunuchs, Women and Children; ſo that it may not be altogether ſtrange, if one ſhould affirm, there were 200 millions of people, of all ſorts, in that Kingdom.

2. That *Catay* is nothing elſe, but the *Six* Northern Provinces of *China*, ſeparated from the other *Nine*, by the great River *KIANG*; and that the City *Cambalu* is the ſame with that of *Peking*: the *Tartars*, who carry every three years their Tribute to the Emperor of *China*, conſtantly calling the ſaid Provinces and City by thoſe names of *Catay*, and *Cambalu*.

3. That *China* is ſo well furniſht with Rivers, and cut Channels, that men may go from the moſt Southern to the moſt Northern part thereof by water, except one daies journey; as the Dutch Ambaſſadours did, embarking at *Canton*, which is 23 d. 48 m. Northern Latitude, and landing at *Peking*, which is about 40 d; having only travell'd one daies journey over ſome Mountains of the Province *Kiamſi*.

4. That the people of *China* are exceeding induſtrious Huſ-

band-

bandmen, making, among other waies of improving their ſoile, great uſe of Flouding.

5. That the *Phyſicians* of *China* do cure Sickneſſes with much eaſe, and in a ſhort time: That they have very ancient Books of the nature and vertues of Herbs, Trees and Stones: That their Modern Phyſicians (as well as their Ancient ones did) write of the Prognoſticks, Cauſes, Effects, *&c.* of Diſeaſes. That their Remedies conſiſt for the moſt part of *Simples* and *Decoctions, Cauteries, Friction*s; without the uſe of *Bloud-letting:* That they have ſuch an excellent skill and method in feeling the *Pulſe*, that by the means thereof they diſcover even the moſt latent cauſes of Diſeaſes; taking a good half hour, when they viſit a Patient, in feeling and examining his Pulſe: That they preſcribe much the uſe of *The*; and the drinking alwayes warme, whatever they drink: To the cuſtome of both which it's imputed, that the inhabitants of *China* do ſpit very little, nor are ſubject to the Stone or Gout: That they priſe highly the Root *Ginſeng*, as an extraordinary Reſtorative and Cordiall, recovering frequently with it agonizing perſons; one pound of it being paid with 3 pounds of ſilver. As for their *Chymiſts*, (of which they have alſo good ſtore) they go beyond ours, promiſing not only to make Gold, but to give Immortality.

6. That their *Nobility* is raiſed from Learning and Knowledge, without regard to Bloud or Parentage, excepting the Royall Family.

7. That in *CHEKIAN*, a maritime Province, whence is the ſhorteſt cut of *China* to *Japan*, is the beſt and plentifulleſt *Silk-trade* in the world: And that there every year the Mulberries are cutt, and kept down, that they grow not into Trees for the eaſier gathering of the Leaves, there being a *double* Silk-harveſt in that Country, as there is in ſeverall other parts of the Eaſt-indies; (both which there is hope, will ſhortly be imitated in *Virginia*.)

8. That the way of making *Porcelane* is this: (*Which is the rather inſerted here, becauſe it agrees ſo well with an Account, we received a while ſince from a very Curious and intelligent Perſon of Amſterdam.*) There is in the Province of *Nankin* a Town, call'd

Goesfol; whence they draw the Earth for *Porcelaine*, which is found between the Rocks of Mountains. This Earth they beat very small, and stamp it to a very fine Powder, and then put it into Tubs fill'd with water; where the finest part sinks to the bottom. Afterwards 'tis kneaded in the form of small Cubes, of the weight of about 3. *Catti* (a *Catti* being 20 Ounces.) These pieces thus wrought are sold to the people, that commonly in great numbers fetch them, coming from the Town *Sintesimo* (otherwise *Jontiou*) in the Province of *Kiansy*, being about 50 miles distant from *Wotsing*, neer the City *KIANSY*; which people transport them to their homes, and there bake them in this manner: They heat their Ovens well, for the space of 15 daies successively, and then keep them so close, that no Air may get in; and after 15 *other* daies are pass'd, they open the Oven in the presence of an Officer, who takes every fifth vessel of each fashion for the service of the Emperor: Which done, the rest is sold to those of *Vcienien*, whence it is transported all over the Country. So that the Earth is not prepared in *Nankin*, where 'tis found, because the people of that Province have not the skill of working it, as the other above-mention'd; who also alone have the Art of coloring it, which they keep as a great Secret, not teaching it to any, but their Children and next Kindred.

9. That *Musk* is nothing else, but the Testicles of a Beast like a Dear, found in the Province of *Honan*; and that, when tis good and unmixt, as it comes from the Animal, they sell it even in *Nankin* and *Pekin*, for 30. or 35. *Teyls* (that is, about so many Crowns) the *Catti*.

Many other curious informations might be borrow'd from this Author, concerning the Customs, Studies, Exercises of the *Chinese*; of the number of the people of each Province; of the Natural productions of the Earth and Rivers there; of the Structure and Antiquity of their Wall; of the Magnificence of their Porcelain Tower &c; but, remitting for these things to the Book it self, we shal only add a piece of Oeconomy, used by the *Holland*-Merchants in their Commerce with *China*; which is, that they dry abundance of Sage-leaves, role them up, and

prepare

prepare them like *The*, and carrying it to *China*, as a rare drogue, get for one pound of it, fourtimes as much *The*.

A DISCOURSE ABOUT THE CAUSES OF THE INUNDATION OF THE NILE, in *French*. The Author of this Book is Monſieur *dela Chambre*, who being perſwaded from ſeveral Circumſtances, that accompany the Overflowing of this River, that it cannot proceed from Rain, ventures to aſſign for a Cauſe of *it*, and of all the other effects that happen at the time of its ſwelling, the *Niter*, wherewith that water abounds.

The diſcourſe having ſix parts, the Author endeavours to ſhew in the

Firſt, that the Waters of the *Nile* are Nitrous, explicating the Nature of Salt, and Saltpeter, and imputing the fertility of the Earth, as well as the fecundity of Animals, to Salt. Where he ſhews, that all things, that ſerve to improve Land, are full of Salt; and that 'tis obſerv'd, that grain ſteep'd in Vrine, before ſowing, riſes ſooner, and becomes fuller and ſtronger, than elſe. Adding, that that, which renders the Seed of Animals prolifick, is, that one of the *Spermatick* veins hath its Origine from the *Emulgent*, through which the Nitrous and Saline Serofities, that diſcharge themſelves into the Kidneys and Bladder, do paſs.

In the *Second*, he examins, what is Fermentation, and how 'tis perform'd; affirming, that, what thruſts forth Plants in the Spring, is, that the Earth being fermented by the *Niter*, it harbours, the Nitrous ſpirits inſinuate themſelves into their Pores.

In the *Third* he treats of all the Circumſtances, obſervable in the Inundation of the Nile. 'Tis affirm'd, that 3 or 4 days before that River begins to overflow, all its water is troubled: that then there falls a certain Dew, which hath a fermenting vertue, and leavens a Paſte expoſed to the Air: that the Mud, which has been drawn out of the water, grows heavier, when the overflowing begins, then it was before, and that by the increaſe of the weight of that Mud, they Judge of the greatneſs of the approaching inundation. The Author pretends, that the

the Niter, which the *Nile* is ſtored with, is the cauſe of all theſe ſtrange effects, and of many others, by him alledged. For, *ſaith he*, when the Nitre is heated by the heat of the Sun, it ferments, and mingling with the water, troubles it, and ſwells it, and makes it paſs beyond its banks; after the ſame manner, as the Spirits in new Wine render it troubled, and make it boyle in the veſſel. And it ſeems not likely to him, that the Mud, found in the *Nile*, ſhould come a far off; for then it would at laſt ſo raiſe the banks of this River, that it would not be able to overflow them any longer. Whereas 'tis more than 2000 years, that the banks thereof are not grown higher, there being now requiſite but 16. cubits for overflowing the Land, no more than there was in the time of *Herodotus*. Which ſhews, *ſaith he*, that this Mud is nothing but a volatil *Niter*, which exhaling, doth not increaſe the Earth. As for the *Ægyptian* Dew, and the increaſe of the weight of the Mud, he adſcribes them to the ſame Cauſe. For, the ſpirits of Nitre abounding in the *Nile*, when raiſed into the Air with the vapors, that exhale continually from this River, there is made out of their mixture, a Dew, that refreſhes the Air, makes ſickneſs to ceaſe, and produces all thoſe admirable effects, that make the *Ægyptians* wiſh for it ſo paſſionately. And the ſame ſpirits of Niter, being joyned to the Paſte, and to the Mud, raiſe the one, and augment the weight of the other. That, which Mr. *Buratini* obſerves, that at the time of this inundation, the Niter-pits of the neighbouring places vomit out liquid Niter, and that one may ſee iſſue out of the Earth abundance of Chryſtals of Nitre, is alledged to fortify this conjecture; Which is yet more confirm'd by the Fertility, communicated to the Earth by the Mud of this River. For, plants do grow there in ſuch abundance, that they would choak one another, if it were not remedied by throwing Sand upon the Fields; inſomuch that the *Ægyptians* muſt take as much pains to ſpread Sand to leſſen the fatneſs of their Land, as other Nations do, to ſpread dung or other manure upon theirs to increaſe the fatneſs.

In the *Fourth* and *Fifth*, the Author undertakes to prove, that all thoſe ſtrange effects cannot be attributed to Rain or Snow, and

and that the overflowing of the *Nile* always happens at a certain day.

In the *Laſt*, he alledges ſome Relations, ſerving to confirm his Opinion: Which are too long here to inſiſt upon.

DE PRINCIPIIS ET RATIOCINATIONE GEOMETRARUM; *Contra Faſtum Profeſſorum Geometriæ*; Authore *Thoma Hobbes*. It ſeems, that this Author is angry with all Geometricians, but himſelf; yea he plainly ſaith in the dedication of his Book, that *he invades the whole Nation of them*; and unwilling, it ſeems, to be call'd to an account for doing ſo, *He* will acknowledge no judge of *this* Age; but is full of hopes, that poſterity will pronounce for him. Mean while he ventures to advance this *Dilemma*; *Eorum qui de iiſdem rebus mecum aliquid ediderunt, aut ſolus inſanio Ego, aut ſolus non inſanio; tertium enim non eſt, niſi (quod dicet forte aliquis) inſaniamus omnes.* Doubtleſs, one of theſe will be granted him.

As to the Book it ſelf, he profeſſes, that he doth not write it againſt *Geometry*, but *Geometers*: and that his deſign in it is, to ſhew, That there is no leſs uncertainty and falſity in the writings of *Mathematicians*, than there is in thoſe of *Naturaliſts*, *Moraliſts*, &c. though he judges, that *Phyſicks*, *Ethicks*, *Politicks*, if they were well demonſtrated, would be as certain as the *Mathematicks*.

Attacking the Mathematical Principles as they are found in Books, and withall ſome Demonſtrations, he takes to task *Euclid* himſelf, inſtead of all, as the Maſter of all Geometricians, and with him his beſt interpreter, *Clavius*, examining in the *Firſt* place, the *Principles* of *Euclid*: *Secondly*, Declaring falſe, what is ſuperſtructed upon them, whether by *Euclid*, or *Clavius*, or any *Geometer* whatſoever that hath made uſe of thoſe or other (as he is pleaſed to entitle them) *falſe* Principles. *Thirdly*, Pretending, that he means ſo to combat all, both Principles and Demonſtrations, undertaken by him, as that he will ſubſtitute better in their room, leaſt he ſhould ſeem to undermine the Science it-ſelfe.

The

The particulars, which he undertakes to reform, are,

Punctum.
Linea.
Terminus.
Linea Recta.
Superficies.
Superficiei Termini.
Superficies Plana,
Angulus (Where he is large upon the *Angulus Contactus.*)
Petitio prima Elem. 1. *Euclidis.*
Ratio.
Radix & Latus.
Prop. 16. *El.* 3.
Dimensio Circuli.
Magnitudo Circuli Hugeniana,
Sectio Anguli.
Ratio, quam habet recta composita ex Radio & Tangente 30. *grad, ad Radium ipsum,*
Propos. 47 *æ. Elem.* 1. *Demonstratio.*
Addita est Appendix de Mediis proportionalibus in genere.

KING SALOMONS POURTRAITURE OF OLD AGE; by *John Smith*, M.D. This Treatise being a *Philosophical* Discourse, though upon a *Sacred* Theme, may certainly claim a place among *Philosophical* Transactions. Not here to mention the many other learned Notes, this Worthy Author gives upon that Hieroglyphical Description of Old Age, made by that Royal Pen-man of *Ecclesiastes*, cap. 12. We shall onely take notice of that surprizingly Ingenious one, there to be met with, concerning the Antiquity of the Doctrine of the *Blood's Circulation*: King *Salomon*, who lived neer 2700 years agoe, using such expressions, as may, to a considering Reader, very probably denote the same Doctrine, which the Sagacious Dr. *Harvey* has of late years so happily brought to light, and introduced into all the most Ingenuous Societies of Learned men: The *Pitcher*, mention'd in the quoted place, being Interpreted for the *Veines*, and the *Fountain*, for the *Right Ventricle of the Heart*, as the *Cistern*, for the *Left*; the *Wheele*, there spoken off, manifestly importing a *Circulation*, made by the *Great Artery* with its Branches, the principal Instrument thereof.

Printed with Licence for *John Martyn*, and *James Allestry*, Printers to the Royal Society. 1666.

PHILOSOPHICAL TRANSACTIONS.

Wednesday, July 18. 1666.

The Contents.

A new Experiment, shewing, How a considerable degree of Cold may be suddenly produced without the help of Snow, Ice, Haile, Wind, *or* Niter, *and that at any time of the year. An Account of two Books, lately printed in* London; *whereof the one is entituled,* EUCLIDIS ELEMENTA GEOMETRICA, novo ordine ac Methodo demonstrata; *the Author* Anonymus. *The other,* THE ENGLISH VINE-YARD VINDICATED, *by* JOHN ROSE.

A new Frigorifick Experiment shewing, how a considerable degree of Cold *may be suddenly produced without the help of* Snow, Ice, Haile, Wind, *or* Niter, *and that at any time of the year.*

THis subject will it self, 'tis presumed, without any other *Preamble*, speak the Cause, why this present Paper is publish't at this (unusual) time of the Month: though, by the by, it may not be amiss to add on this occasion, that the Publisher of these *Tracts* never meant so to confine himself to a *Set* time, as not to retain the Liberty of taking any other, when there is occasion. And there being one given him, before another Month is come in, he does without any scruple or delay comply therewith, presenting the Curious with an Experiment which he thinks is both seasonable, and will not be unwellcome to them; furnish't out of the Ample Magazin of that Philosophical *Benefactor*, the Noble Mr. *Boyle*; Concerning which, thus much is further thought requisite to intimate on this occasion, that it, and some others of the same Gentlemans, that have been, and may be, mentioned in the *Transactions*, belong to certain Treatises, the Author hath lying by him; but that yet he denys not

to communicate them to his Friends, and to allow them to dispose thereof, upon a hope, that equitable Readers will be ready to excuse, if hereafter they should appear also in the Treatises they belong to, since he consents to this Anticipation, but to comply with those, that think the imparting of real and practical Experiments, may do the Publick some Service, by exciteing and assisting mens Curiosity in the interim.

As for the Experiment, you saw the other day at my Lodgings, though it belongs to some Papers about *Cold*, that (you know) could not be Publish't, when the rest of the *History* came forth, and therefore was reserved for the next *Edition* of that Book; yet the Weather having been of late very hot, and threatning to continue so, I presume, that to give you here in compliance with your Curiosity an Account of the Main and Practical part of the Experiment, may enable you to gratify not onely the Curious among your Friends, but those of the Delicate, that are content to purchase a Coolness of Drinks at a somewhat chargeable rate.

You may remember, that the Spring before the last, I shew'd you a particular Account of a way, wherein by a certain substance obtain'd from *Sal Armoniack*, I could presently produce a considerable degree of *Cold*, and that with odd Circumstances, without the help of *Snow*, *Ice*, *Niter* &c. But that Experiment being difficult and costly enough, and design'd to afford men *Information*, not *Accommodations*, I afterwards tryed, what some more cheap and facile mixtures of likely Bodies with *Sal Armoniack* would do towards the Production of Cold, and afterwards I began to consider, whether to that purpose alone (for my first experiment was design'd to exhibite other *Phænomena* too) those mixtures might not without inconvenience be omitted: and I was much confirm'd in my conjecture, by an accident, which was casually related to me by a very Ingenious Physician of my acquaintance, but not to be repeated to you in few words, though he complain'd, he knew not what to make of it.

Among the several ways, by which I have made infrigidating Mixtures with *Sal Armoniack*, the most simple and facile is this: Take one pound of powder'd *Sal Armoniack*, and about three Pints (or pounds) of Water, put the Salt into the Liquor, *either* altogether, if your design be to produce an intense, though

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but a ſhort coldneſs; *or* at two, three, or four ſeveral times, if you deſire, that the produced coldneſs ſhould rather laſt ſomewhat longer than be ſo great. Stirre the powder in the Liquor with a ſtick or whalebone (or ſome other thing, that will not be injur'd by the fretting Brine, that will be made) to haſten the diſſolution of the Salt; upon the quickneſs of which depends very much the intenſity of the Cold, that will enſue upon this Experiment. For the clearing up whereof, I ſhall annex the following particulars.

1. That a conſiderable degree of Cold is really produced by this operation, is very evident: *Firſt*, to the touch; *Secondly*, by this, that if you make the Experiment (as for this reaſon I ſometimes chuſe to do) in a Glaſs-*B*ody or a Tankard, you may obſerve, that, whilſt the Solution of the Salt is making, the outſide of the Metalline Veſſel will, as high as the mixture reaches within, be bedew'd (if I may ſo ſpeak) with a multitude of little Drops of Water, as I have * elſewhere ſhown that it happens, when mixtures of Snow and Salt, being put into Glaſſes or other Veſſels, the aqueous vapors, that ſwim to and fro in the Air, and chance to glide along the ſides of the Veſſels, are by the coldneſs thereof condens'd into Water. And in our Armoniack Solution you may obſerve, that if you wipe off the Dew from any particular part of the outſide of the Veſſel, whilſt the ſolution does yet vigorouſly goe on, it will quickly collect freſh Dew, which may be ſometimes copious enough to run down the ſides of the Veſſel. *But Thirdly*, the beſt and ſureſt way of finding out the Coldneſs of our Mixture is that, which I ſhew'd you by plunging into it a good ſeal'd Weatherglaſs furniſh't with tincted Spirit of Wine. For, the *B*all of this being put into our frigorifick mixture, the Crimſon Liquor will nimbly enough deſcend much lower, than when it was kept either in the open Air, in common Water, of the ſame temper with that, wherein the *Sal Armoniack* was put to diſſolve. And if you remove the Glaſs out of our Mixture into common water, the tincted Spirit will, (as you may remember, it did) haſtily enough reaſcend for a pretty while, according to the greater or leſſer time, that it continued in the *Armoniack* Solution. And this has ſucceeded with me, when inſtead of removing the Mixture into *Common* Water, I removed it into water newly impreguated with *Salt-peter*.

* *In the Hiſtory of Cold.*

2. The *Duration* of the Cold, produc'd by this Experiment, depends upon ſeveral Circumſtances; as *Firſt*, upon the Seaſon of the year, and preſent temperature of the Air; For, in Summer and Hot weather the Cold will ſooner decay and expire. *Secondly*, upon the Quantity of the Salt and Water: For, if both theſe be great, the effect will be as well more laſting, as more conſiderable. *Thirdly*, for ought I yet know, we may here add the Goodneſs & Fitneſs of the particular parcel of Salt, that is imploy'd: for, though it be hard to diſcern beforehand, which will be the more, and which the leſs proper; yet ſome trials have tempted me to ſuſpect, that there may be a conſiderable diſparity, as to their fitneſs to produce Cold, betwixt parcels of Salt, that are without ſcruple look't upon as Sal Armoniack: Of which difference it were not perhaps very difficult to aſſign probable reaſons from the Nature of the Ingredients of this compound Concrete, and the waies of preparing it. But the Duration of the Cold may be conceived to depend alſo, *Fourthly*, upon the Way of putting in the Salt into the Water. For, if you caſt it in all at once, the Water wil ſooner acquire an intenſe degree of Coldneſs; but it will alſo the ſooner return to its former temper; Whereas, if you deſire but an inferiour degree of that Quality, but that may laſt longer (which wil uſually be the moſt convenient for the Cooling of Drinks,) then you may put in the Salt by little and little. For, keeping a long Weather-glaſs for a good while in our impregnated Mixture, I often purpoſely try'd, that, when the tincted liquor ſubſided but ſlowly, or was at a ſtand, by putting in, from time to time, 2. or 3. ſpoonfuls of freſh Salt, and ſtirring the Water to quicken the Diſſolution, the Spirit of Wine would begin again to deſcend, if it were at a ſtand or riſing, or ſubſide much more ſwiftly than it did before. And if you would lengthen the Experiment, it may not be amiſs, that part of the Sal Armoniack be but groſly beaten, that it may be the longer in diſſolving, and conſequently in Cooling the Water. Whilſt there are dewy drops produced on the outſide of the Veſſel, 'tis a ſign, that the Cold within continues pretty ſtrong; for, when it ceaſes, theſe drops eſpecially in warm weather, will by degrees vaniſh. But a *ſurer* way of meaſuring the duration of the Cold, is, by removing from time to time the Seal'd Weather-glaſs out of the Saline Mixture into the ſame common Water, with part of which it was made. And though it be not eaſie to determin any thing particularly about this matter; yet it may ſomewhat aſſiſt you in your Eſtimates, to be inform'd, That I have in the Spring by a good Weather-glaſs found a ſenſible adventitious Cold, made by a pound of Sal Armoniack at the utmoſt, to laſt about 2. or 3. hours.

3. To cool Drinks with this Mixture, you may put them in *thin* Glaſſes, the thinner the better; which (their orifices being ſtopp'd, and ſtill kept above the Mixture) may be mov'd to and fro in it, and then be immediately pour'd out to be drunk: Though, when the Glaſs, I imployed, was conveniently ſhap'd, as, like a Sugar-loaf, or with a long Neck, I found it not amiſs to drink it out of that, without pouring it into any other; which can ſcarce be done without leſſning the Coolneſs. The refrigeration, if the Glaſs viall be convenient, is quickly perform'd: And if one have a mind to cool his hands, he may readily do it by applying them to the outſide of the Veſſel, that contains the refrigerating Mixture; by whoſe help, pieces of Chryſtal, or Bullets for the cooling of

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the Mouths or Hands of thoſe patients, to whom it may be allow'd, may be potently cool'd, and other ſuch refreſhments may be eaſily procur'd.

4. How far Sal Armoniack, mingl'd with Sand or Earth, and not diſſolv'd, but only moiſtn'd with a little Water ſprinkl'd on it, will keep Bottles of Wine or other liquors more coole, than the Earth or that *S*and alone will do, I have not yet had opportunity by ſufficient trials fully to ſatisfie my ſelf, and therefore reſign that Enquiry to the Curious.

5. For the cooling of Air, and Liquors, to adjuſt Weather-glaſſes (to be able to do ~~which~~, at all times of the year, was one of the chief aimes, that made me bethink my ſelf of this Experiment;) or to give a ſmall quantity of Beer &c. a moderate degree of coolneſs, it will not be requiſite, to employ neer ſo much as a whole pound of Sal Armoniack at a time. *F*or, you may eaſily obſerve by a ſeal'd Weather-glaſs, that a very few ounces, well pouder'd and nimbly diſſolv'd in about 4. times the weight of Water, will ſerve well enough for many purpoſes.

6. And that you may the leſs, ſcruple at this, I ſhall tell you, that even before and after Midſummer, I have found the Cold producible by our Experiment to be conſiderable and uſeful for refrigerating of Drinks, &c. but if the Sal Armoniack be of the fitteſt ſort (for I intimated above, that I ſuſpected, 'tis not equally good) and if the ſeaſon of the year do make no diſadvantagious difference, the degree of Cold, that may be produced by no more than one pound (if not by leſs) of Sal Armoniack, may, within its own Sphere of Activity, be much more vehement, than, I preſume, you yet imagine, and may afford us excellent Standards to adjuſt ſeal'd Weather glaſſes by; and for ſeveral other purpoſes. For I remember that in the Spring, about the end of *March*, or beginning of *April*, I was able with one pound of Sal Armoniack, and a requiſite proportion of Water, to produce a degree of Cold much greater, than was neceſſary the preceding Winter, to make it froſty Weather abroad; nay I was able to produce real Ice in a ſpace of time, almoſt incredibly ſhort. To confirm which particulars, becauſe they will probably ſeem ſtrange to you, I will here annex the Tranſcript of an entry, that I find in a Note book of the *Phænomena* and ſucceſs of one of thoſe Experiments, as I then tryed it; though I ſhould be aſham'd to expoſe to your peruſal a thing ſo rudely pen'd, if I did not hope, you would conſider, that 'twas haſtily written onely for my own Remembrance. And that you may not ſtop at anything in the immediately annext Note, or the two, that follow, it will be requiſite to premiſe this Account of the ſeal'd Thermoſcope, (which was a good one) wherewith theſe Obſervations were made; That the length of the Cylindrical pipe was 16. Inches; the Ball, about the bigneſs of a ſomewhat large Walnut, and the Cavity of the Pipe by gueſs about an eight or ninth part of an inch Diameter.

The Firſt Experiment is thus regiſtred. *March* the 27th, in the Seal'd Weather glaſs, when firſt put into the Water, the tinged Spirit reſted at $8\frac{5}{8}$ inches: being ſuffered to ſtay there a good while, and now and then ſtirr'd to and fro in the Water; it deſcended at length a little beneath $7\frac{1}{8}$ inches: then the *Sal Armoniack* being put in, within about a quarter of an hour or a little more it deſcended to $2\frac{11}{16}$ inches, but before that time, in half a quar-

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ter of an hour it began manifeſtly to freeze the vapours and drops of water on the outſide of the Glaſs. And when the frigorifick power was arriv'd at the height, I ſeveral times found, that water, thinly plac'd on the outſide, whilſt the mixture within was nimbly ſtirr'd up and down, would freeze in a quarter of a minute (by a Minute-watch.) At about $\frac{3}{4}$ of an hour after the infrigidating Body was put in, the Thermoſcope, that had been taken out a while before, and yet was riſen but to the loweſt freezing mark, being again put in the liquor, fell an inch beneath the mark. At about $2\frac{1}{2}$ houres from the firſt Solution of the Salt I found the tincted liquor to be in the midſt between the freezing marks, whereof the one was at $5\frac{1}{2}$ inches (at which height when the Tincture reſted, it would uſually be, ſome, though but a ſmall, Froſt abroad;) and the other at $4\frac{3}{4}$ inches; which was the height, to which ſtrong and durable Froſts had reduced the liquor in the Winter. At 3. hours after the beginning of the Operation, I found not the Crimſon-liquor higher than the upper Freezing mark newly mention'd; after which, it continued to riſe very ſlowly for about an hour longer; beyond which time I had not occaſion to obſerve it.

Thus far the *Note-book*; wherein there is mention made of a Circumſtance of ſome former Experiments of the like kind, which I remember was very conſpicuous in this newly recited. *For*, the frigorifick mixture having been made in a Glaſs-body (as they call it) with a large and flattiſh bottom, a quantity of water, which I (purpoſely) ſpilt upon the Table, was by the operation of the mixture within the Glaſs, made to freeze, and that ſtrongly enough, the bottom of the Cucurbite to the Table; that ſtagnant liquor being turn'd into ſolid Ice, that continued a conſiderable while unthaw'd away, and was in ſome places about the thickneſs of a half Crown piece.

Another Obſervation, made the ſame Spring, but leſs ſolemn, as meant chiefly to ſhew the Duration of Cold in a high degree, is recorded in theſe terms: The firſt time, the Seal'd Weather-glaſs was put in, before it touch'd the common water, it ſtood at $8\frac{1}{8}$, having been left there a conſiderable while, and once or twice agitated the water, the tincted liquor ſunk but to $7\frac{7}{8}$, or at furtheſt, $7\frac{6}{8}$; then the frigorifick liquor being put into the water with circumſtances diſadvantagious enough, in (about) half a quarter of an hour the tincted liquor fell beneath $3\frac{3}{4}$; and the Thermoſcope, being taken out, and then put in again, an hour after the water had been firſt infrigidated, ſubſided beneath 5 inches, and conſequently within $\frac{1}{4}$ of an inch of the mark of the ſtrongly freezing weather.

7. Whereas the grand thing, that is like to keep this Experiment from being as generally *Uſeful*, as perhaps it will prove *Luciferous*, is the Dearneſs of Sal Armoniack; two things may be offered to leſſen this Inconvenience. For *firſt*, Sal Armoniack might be made much cheaper, if inſtead of fetching it beyond-ſea, our Country-men made it here at home; (which it may eaſily be and I am ready to give you the Receipt, which is no great Secret.) But *next*, I conſidered, that probably the infrigidating vertue of our mixture might depend upon the peculiar Texture of the Sal Armoniack, whereby, whileſt the Water is diſſolving it, either ſome Frigorifick particles are extricated and excited, or (rather) ſome particles, which did before more agitate the minute parts of the water, are expell'd (or invited out by the ambient Bodies) or

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come to be clogg'd in their motion: Whence it seem'd reasonable to expect that upon the Reunion of the Saline particles into such a Body, as they had constituted before, the redintegrated Sal Armoniack having, neer upon, the same Texture, would, upon its being redissolv'd, produce the same, or a not much inferior degree of Coldness: And hereupon, though I well enough foresaw that an Armoniack solution, being boyl'd up in *E*arthen vessels (for Glass ones are too chargeable) would, by piercing them, both lose some of the more subtle parts, and thereby somewhat impaire the texture of the rest; yet I was not deceiv'd in *E*xpecting, that the dry Salt, remaining in the pipkins, being redissolv'd in a due proportion of water, would very considerably infrigidate it; as may further appear by the Notes, which for your greater satisfaction you will find here subjoyn'd; as soon as I have told you, that, though for want of other vessels I was first reduc'd to make use of *E*arthen ones, and the rather, because some Metallin Vessels will be injur'd by the dissolv'd Sal Armoniack, if it be boyl'd in them; yet I afterwards found some conveniencies in Vessels of other Mettall, as of Iron; whereof you may command a further Account.

March the 29th, the Thermoscope in the Air was at $8\frac{7}{8}$ inches; being put into a somewhat large evaporating glass, fill'd with water, it fell (after it staid a pretty while, and had been agitated in the liquor) to 8. inches: then about half the Salt, or less, that had been used *twice* before, and felt much less cold than the water, being put in and stirr'd about, the tincted Spirit subsided with a visible progress, till it was faln manifestly beneath 4. inches; and then, having caused some water to be freshly pump'd and brought in, though the newly mention'd Solution were mixt with it, yet it presently made the Spirit of Wine manifestly to ascend in the Instrument, much faster, than one would have expected, *&c.*

And thus much may suffice for this time concerning our *Frigorifick* Experiment; which I scarce doubt but the *Cartesians* will lay hold on as very favourable to some of their Tenents; which you will easily believe, it is *not* to the Opinion, I have elsewhere oppos'd, of those Modern Philosophers, that would have *Salt-petre* to be the *Primum Frigidum:* (though I found by trial, that, whilst 'tis actually dissolving, it gives a much considerabler degree of Cold, than otherwise.) But about the Reflexions, that may be made on this Experiment, and the Variations, and Improvements, & Uses of it, though I have divers things lying by me; yet, since you have seen several of them already, and may command a sight of the rest, I shall forbear the mention of them here, not thinking it proper, to swell the bulk of this Letter with them.

An Account of two Books lately printed in London.

1. *EUCLIDIS ELEMENTA GEOMETRICA, novo ordine ac methodo demonstrata.* In this compendious and pretty Edition, the Anonymous Author pretends to have rendred these Elements more expeditious; by bringing all together into one place, what belongs to one and the same subject: Comprising 1. what *Euclid* hath said of *Lines*, Streight, Intersecting one another, and Parallel. 2. What he hath demonstrated of a *Single Triangle*, and of *Triangles Compared* one with another. 3. What of the *Circle*, and its Properties. 4. What of *Proportions* in Triangles and other Figures. 5. What of *Quadrats* and *Rectangles*, made of Lines diversly

cut. 6. What of *Plane Superficies's*. 7. What of *Solids*. After which follow the *Problems*. The *Definitions* are put to each *Chapter* as need requireth. The *Axioms* because they are few, and almost every where necessary, are not thus distributed in *Chapters*. The *Postulata*, are not subjoyn'd to the *Axioms*, but reserv'd for the *Problems*, the Author esteeming, that they being *practical* Principles, had only place in *Problems*.

This for the *Order*: As to the *Manner* of Demonstrating, One and the same is observ'd in most Propositions; all with much brevity; to the end, that what is not of it self difficult, may not be made so, by multitude of Words and Letters.

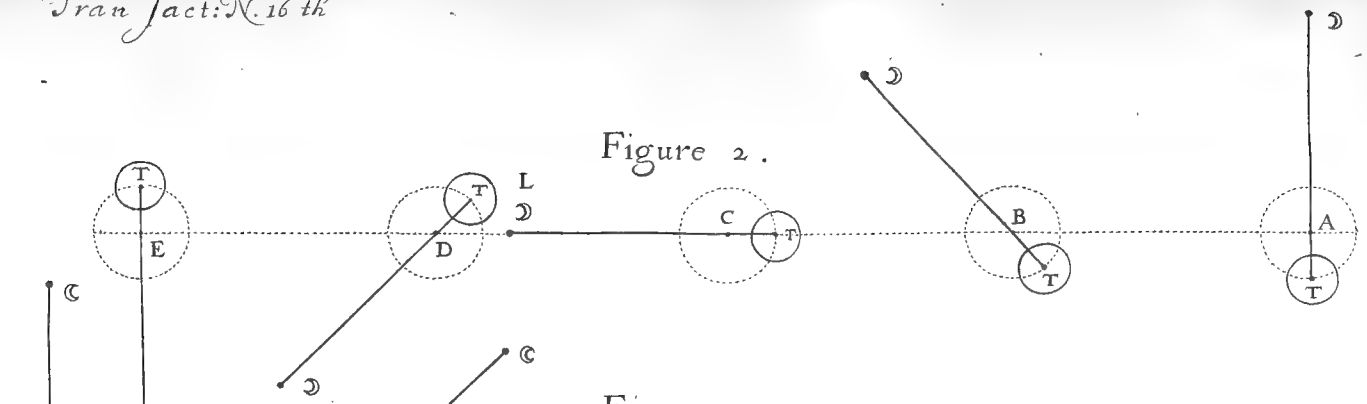
II *THE ENGLISH VINE-YARD VINDICATED*. The Author (Mr. *John Rose*, his Majesties Gardener at his Royal Garden in St. *James's*) makes it his business in this small Tract (a very thin Pocket-book) by a few short Observations made by himself, to direct *Englishmen* in the *Choice* of the *Fruit*, and the *Planting* of Vine-yards, heretofore very frequently cultivated, though of late almost quite neglected by them.

He discourses skilfully, 1. Of the *several sorts* of *Vines*, and what *Grapes* are most futable to the *Climate* of *England*; where he chiefly commends the small *Black-grape*, or *Cluster-grape*; the *Parsley grape*; the White *Muscadine*; the *Frontiniack*; and a new *White-grape*, with a red Wood and a dark green Leaf: All these being early ripe fruit. 2. Of the *Soyle*, and *Scituation* of a Vine-yard in *England*: Where, as to the *First*, he pitches upon a *Light Soile*, having a bottom of *Chalk* or *Gravel*, and given to *Brambles*, observing, that no Plant whatsoever is so connatural to the Vine for Soyl, as the *Bramble*. As for the *Scituation* he chooses that side or declivity of a Hill, that lies to the *South* or *Southwest*; and is favoured with *other Hills* somewhat higher, or *Woods* on the *North* and *East*, to break the rigour of those quarters. This direction he thinks of that importance, that he affirms, that the discouragement of the Culture of Vines in *England* has only proceeded from men's misinformation on this material article of *Choice* of *Soyle* and *Situation*. 2. How to *prepare* the Ground for the Plantation, *vid.* by plowing up the *Swarth* in *July*, and by disposing the *Turf* in *small* heaps, and so burning them, and spreading the ashes over the Land; care being taken, that by heaping too much materials together, the Earth be not over burnt by the excessive heat and fire, which they require to reduce them to ashes.

What is added, of the Manner of planting the *Sets*; of Dressing, Pruning and Governing the Plantation; of the Ordering and Cultivating the Vine-yard after the first four years, till it needs renewing; as also of the *manner* and *time*, how and when to manure the Vine-yard, with Compost, will be better understood from the Book it self, than can be here described; the Author pretending, that, those few observations of his, as the native production of his own Experience, being practised with care, the Vine-yards in *England* may be planted, govern'd and perpetuated with undoubted success; and offering withall to furnish those, that have a desire to renew this Culture, and to store their grounds with *Sets* and *Plants* of all those sorts, which he recommends; he having a plentiful *stock* of them all.

Printed with Licence for *John Martyn*, and *James Allestry*, Printers to the Royal Society. 1666.

Figure 2.



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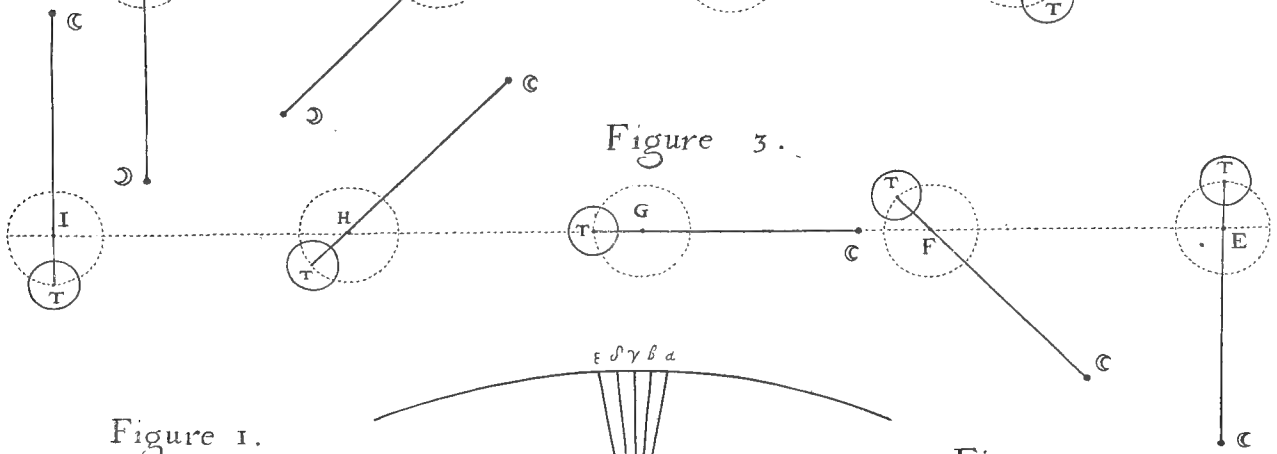
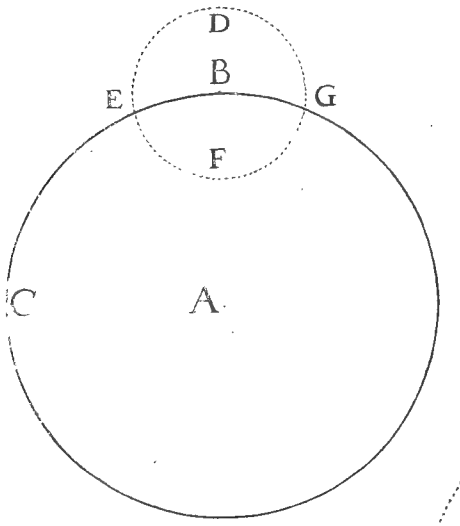


Figure 1.



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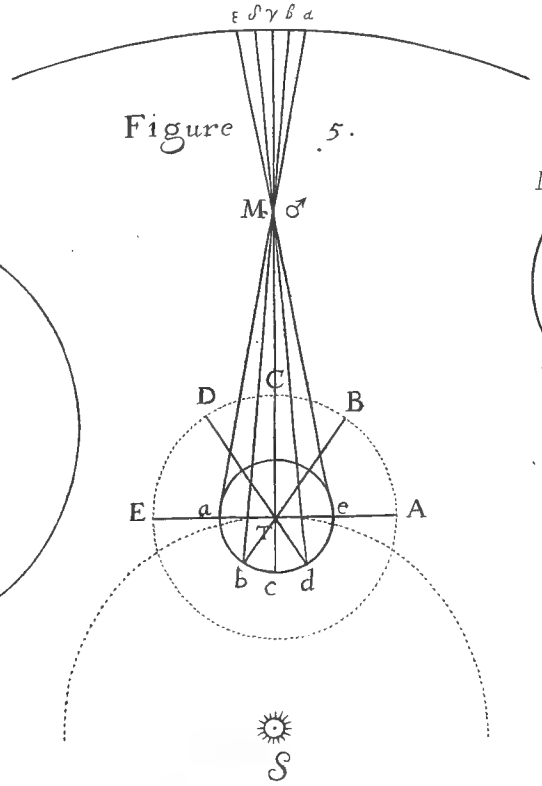

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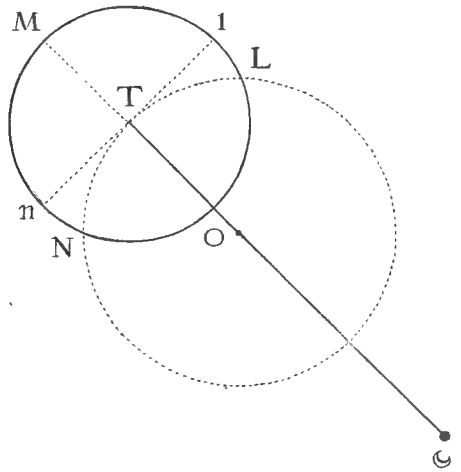

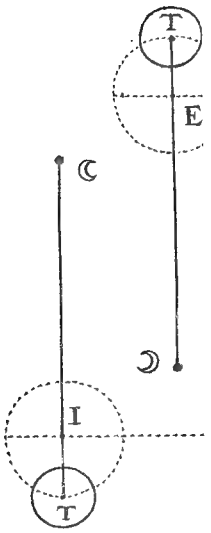

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PHILOSOPHICAL TRANSACTIONS.

Munday, Auguſt 6. 166[illegible].

The Contents.

An Eſſay of Dr. John Wallis, *exhibiting his* Hypotheſis *about the* Flux and Reflux of the Sea, *taken from the Conſideration of the* Common Center of Gravity of the Earth and Moon; *together with an* Appendix *of the ſame, containing an* Anſwer *to ſome* Objections, *made by ſeverall Perſons againſt that* Hypotheſis. *Some Animadverſions of the ſame* Author *upon Maſter* Hobs's *late Book,* De Principiis & Ratiocinatione Geometrarum.

An Eſſay
Of Dr. John Wallis, *exhibiting his* Hypotheſis *about the* Flux and Reflux of the Sea.

HOw abſtruſe a ſubject in Philoſophy, the *Flux and Reflux of the Sea* hath proved hitherto, and how much the ſame hath in all Ages perplexed the Minds even of the beſt of *Naturaliſts*, when they have attempted to render an Account of the Cauſe thereof, is needleſs here to repreſent. It may perhaps be to more purpoſe, to take notice, that all the deficiencies, found in the *Theories* or *Hypotheſes*, formerly invented for that End, have not been able to deterre the Ingenious of *this* Age from making farther ſearch into that Matter: Among whom that Eminent Mathematician Dr. *John Wallis*, following his happy *Genius* for advancing reall Philoſophy, hath made it a part of his later Inquiries and Studies, to contrive and deduce a certain Hypotheſis concerning that *Phænomenon*, taken

from the Consideration of the *Common Center of Gravity of the Earth and Moon*, This being by several Learned Men lookt upon, as a very rational Notion, it was thought fit to offer it by the Press to the Publick, that other Intelligent Persons also might the more conveniently and at their leisure examine the *Conjecture* (the Author, such is his Modesty, presenting it no otherwise) and thereupon give in their sense, and what Difficulties may occur to them about it, that so it may be either confirm'd or laid aside accordingly; As the *Proposer* himself expressly desires in the Discourse, we now, without any more *Preamble*, are going to subjoyn, as it was by him addressed, by way of Letter, from *Oxford* to Mr. *Boyle April* 25. 1666. and afterwards communicated to the *R. Society*, as follows:

YOu were earnest with me, when you last went from hence, that I would put in writing somewhat of that, which at divers times, these three or four years last past, I have been discoursing with your self and others concerning the *Common Center of Gravity of the Earth and Moon*, in order to salving the *Phænomena* as well of the *Seas Ebbing and Flowing*; as of some perplexities in *Astronomical Observations* of the *Places* of the Celestial Bodies.

How much the World, and the great Bodies therein, are manag'd according to the *Laws of Motion*, and *Statick Principles*, and with how much more of clearness and satisfaction, many of the more abstruse *Phænomena* have been salved on such Principles, within this last Century of years, than formerly they had been; I need not discourse to you, who are well versed in it. For, since that *Galilæo*, and (after him) *Torricellio*, and others, have applied *Mechanick* Principles to the salving of *Philosophical* Difficulties; *Natural Philosophy* is well known to have been rendered more intelligible, and to have made a much greater progress in less than an hundred years, than before for many ages.

The *Seas Ebbing and Flowing*, hath so great a connexion with the *Moons* motion, that in a manner all Philosophers (whatever other Causes they have joyned with it) have attributed much of its cause to the *Moon*; which either by some *occult quality*, or

or *particular influence*, which it hath on moyſt Bodies, or by ſome *Magnetick vertue*, drawing the water towards it, (which ſhould therefore make the Water there *higheſt*, where the Moon is *vertical*) or by its gravity and preſſure downwards upon the Terraqueous Globe (which ſhould make it *loweſt*, where the Moon is *vertical*) or by whatever other means (according to the ſeveral Conjectures of inquiſitive perſons,) hath ſo great an influence on, or at leaſt a connexion with, the Sea's Flux and Reflux, that it would ſeem very unreaſonable, to ſeclude the conſideration of the Moons motion from that of the Sea: The *Periods of Tides* (to ſay nothing of the greatneſs of them near the New-moon and Full-moon) ſo conſtantly waiting on the Moon's motion, that it may be well preſumed, that either the one is governed by the other, or at leaſt both from ſome common cauſe.

But the firſt that I know of, who took in the conſideration of the *Earth's* motion, (*Diurnal* and *Annual*) was *Galilæo*; who in his *Syſteme of the World*, hath a particular diſcourſe on this ſubject: Which, from the firſt time that I ever read it, ſeemed to me ſo very rational, that I could never be of other opinion, but that the true Account of this great *Phænomenon* was to be referred to the Earths motion, as the *Principal* cauſe of it: Yet that of the Moon (for the reaſons above mentioned) not to be excluded, as to the determining the *Periods of Tides*, and other circumſtances concerning them. And though it be manifeſt enough, that *Galilæo*, as to ſome particulars, was miſtaken in the account which there he gives of it; yet that may be very well allowed, without any blemiſh to ſo deſerving a perſon, or prejudice to the *main Hypotheſis*: For that Diſcourſe is to be looked upon onely as an *Eſſay* of the *general Hypotheſis*; which as to *particulars* was to be afterwards adjuſted, from a good *General Hiſtory of Tides*; which it's manifeſt enough that he had not; and which is in a great meaſure yet wanting. For were the matter of Fact well agreed on, it is not likely, that ſeveral Hypotheſes ſhould ſo far differ, as that one ſhould make the Water *then* and *there* at the Higheſt, *where* and *when* the other makes it at the Loweſt: as when the Moon is Vertical to the place.

And what I ſay of *Galilæo*, I muſt in like manner deſire to be underſtood of what I am now ready to ſay to you. For I do not profeſs to be ſo well skilled in the Hiſtory of Tides, as that I will undertake preſently to accommodate my *general Hypotheſis* to the *particular caſes*; or that I will indeed undertake for the certainty of it, but onely as an *Eſſay* propoſe it to further conſideration; to ſtand or fall, as it ſhall be found to anſwer matter of Fact. And truly had not your importunity (which is to me a great Command) required me to do it, I ſhould not ſo eaſily have drawn up any thing about it, till I had firſt ſatisfied my ſelfe, how well the Hypotheſis would anſwer Obſervation: Having for divers years neglected to do it, waiting a time when I might be at leiſure throughly to proſecute this deſign.

But there be two reaſons, by which you have prevailed with me, at leaſt to do ſomething. *Firſt*, becauſe it is the common Fate of the *Engliſh*, that out of a modeſty, they forbear to publiſh their Diſcoveries, till proſecuted to ſome good degree of certainty and perfection; yet are not ſo wary, but that they diſcourſe of them freely enough to one another, and even to Strangers upon occaſion; whereby others, who are more haſty and venturous, comming to hear of the notion, preſently publiſh ſomething of it, and would be reputed thereupon, to be the firſt Inventers thereof: though even that little, which they can then ſay of it, be perhaps much leſs, and more imperfect, than what the true Authors could have publiſhed long before, and what they had really made known (publikely enough, though not in print) to many others. As is well known amongſt us as to the buſineſs of the *Lymphatick Veſſels* in *Anatomy*: the *Injection of Liquors into the veines of Living animals*; the *Exhibiting of a ſtraight line equal to a crooked*; the *Spot in Jupiter*, whence his motion about his own Axis may be demonſtrated; and many other the like conſiderable Inventions.

The *other* Reaſon (which, with me, is more really of weight, though even the former be not contemptible) is, becauſe, as I have been already for at leaſt three or four years laſt paſt diverted from proſecuting the inquiry or perfecting the Hypotheſis, as I had thoughts to do; ſo I do not know, but like Emergencies may divert me longer; and whether I ſhall ever ſo do

do it, as to bring it to perfection, I cannot determine. And therefore, if as to my ſelf any thing ſhould *humanitus accidere*; yet poſſibly the notion may prove worth the preſerving to be proſecuted by others, if I do it not. And therefore I ſhall, at leaſt to your ſelf, give ſome general account of my preſent imperfect and undigeſted thoughts.

I conſider therefore, that in the Tides, or the Flux and Reflux of the Sea, beſides extraordinary Extravagancies, or Irregularities, whence great Inundations or ſtrangly high Tides do follow, (which yet perhaps may prove not to be ſo meerly accidental as they have been thought to be, but might from the regular Laws of Motion, if well conſidered, be both well accounted for, and even foretold;) There are theſe *three* notorious Obſervations made of the Reciprocation of Tides. *Firſt*, the *Diurnal* Reciprocation; whereby twice in ſomewhat more than 24. hours, we have a Floud and an Ebbe; or a High-water and Low-water. *Secondly*, the *Menſtrual*; whereby in one *Synodical* period of the Moon, ſuppoſe from Full-moon to Full-moon, the Time of thoſe Diurnal Viciſſitudes doth move round through the whole compaſs of the Νυχθήμερον, or Natural day of twenty four hours: As for inſtance, if at the Full-moon the full Sea be at ſuch or ſuch a place juſt at Noon, it ſhall be the next day (at the ſame place) ſomewhat before One of the clock; the day following, between One and Two; and ſo onward, till at the New-moon it ſhall be at midnight; (the other Tide, which in the Full-moon was at midnight, now at the New-moon coming to be at noon;) And ſo forward till at the next Full-moon, the Full-ſea ſhall (at the ſame place) come to be at Noon again: Again, That of the Spring-tides and Neap-tides (as they are called;) about the Full-moon and New-moon the Tides are at the Higheſt, at the Quadratures the Tides are at the Loweſt: And at the times intermediate, proportionably. *Thirdly*, the *Annual*; whereby it is obſerved, that at ſometimes of the year, the Spring-tides are yet much higher than the Spring-tides at other times of the year: Which Times are uſually taken to be at the Spring and Autumne; or the two Æquinoxes; but I have reaſon to believe (as well from my own Obſervations, for many years, as of others who have been much

much concerned to heed it, whereof more will be ſaid by and by;) that we ſhould rather aſſign the beginnings of *February* and *November*, than the two *Æquinoxes*.

Now in order to the giving account of theſe three Periods, according to the *Laws of Motion* and *Mechanick Principles*; We ſhall *firſt* take for granted, what is now adayes pretty commonly entertained by thoſe, who treat of ſuch matters; *That a Body in motion is apt to continue its motion, and that in the ſame degree of celerity, unleſs hindred by ſome contrary Impediment*; (like as a Body at reſt, to continue ſo, unleſs by ſome ſufficient mover, put into motion:) And accordingly (which daily experience teſtifies) if on a Board or Table, ſome looſe incumbent weight, be for ſome time moved, & have thereby contracted an *Impetus* to motion at ſuch a rate; if that Board or Table chance by ſome external obſtacle, or otherwiſe, to be ſtopped or conſiderably retarded in its motion, the incumbent looſe Body will ſhoot forward upon it: And contrarywiſe, in caſe that Board or Table chance to be accelerated or put forward with a conſiderably greater ſpeed than before, the looſe incumbent Body, (not having yet obtained an equal *Impetus* with it) will be left behind, or ſeem to fly backward upon it. Or, (which is *Galilæo*'s inſtance,) if a broad Veſſel of Water, for ſome time evenly carried forward with the water in it, chance to meet with a ſtop, or to ſlack its motion, the Water will daſh forward and riſe higher at the fore part of the Veſſel: And, contrarywiſe, if the Veſſel be ſuddenly put forward faſter than before; the Water will daſh backwards, and riſe at the hinder part of the Veſſel. So that an Acceleration or Retardation of the Veſſel, which carries it, will cauſe a riſing of the Water in one part, and a falling in another: (which yet, by its own weight, will again be reduced to a Level as it was before.) And conſequently, ſuppoſing the Sea to be but as a looſe Body, carried about with the Earth, but not ſo united to it, as neceſſarily to receive the ſame degree of *Impetus* with it, as its fixed parts do; The acceleration or retardation in the motion of this or that part of the Earth, will cauſe (more or leſs, according to the proportion of it) ſuch a daſhing of the Water, or riſing at one part, with a Falling at another, as is that, which we call the Flux and Reflux of the Sea:

Now

Now this premiſed, We are *next*, with him, to ſuppoſe the Earth carried about with a double motion; The one *Annual*, as (*Fig.* 1.) in B E C the great Orb, in which the Center of the Earth B, is ſuppoſed to move about the Sun A.

The other *Diurnal*, whereby the whole moves upon its own *Axis*, and each point in its ſurface deſcribes a Circle, as D E F G.

It is then manifeſt, that if we ſuppoſe, that the Earth moved but by any one of theſe motions, and that regularly, (with an equal ſwiftneſs;) the Water, having once attained an equal *Impetus* thereunto, would ſtill hold equal pace with it; there being no occaſion, from the Quickening or Slackening of the Earths motion, (in that part where the Water lyeth) for the Water thereon either to be caſt Forward or fall Backward, and thereby to accumulate on the other parts of the Water: But the true motion of each part of the Earths ſurface being compounded of thoſe two motions, the *Annual* and *Diurnal*; (the *Annual* in B E C being, as *Galilæo* there ſuppoſeth, about three times as faſt as a *diurnal* motion in a great Circle, as D E F;) while a Point in the Earths ſurface moves about its Center *B.* from G. to D. and E. and at the ſame time, its Center B. be carried forwards to C; the true motion of that Point forwards, is made up of both thoſe motions; to wit, of B to C, and of G to E; but while G moves by D to E, E moves backward by F to G, contrary to the motion of B to C; ſo that the true motion of E, is but the difference of B C, and E G: (for, beſide the motion of B, the Center G is alſo put forward as much as from G to E; and E put backward as much as from E to G:) ſo that the *Diurnal* motion, in that part of the Earth, which is next the Sun, as E F G, doth abate the progreſs of the *Annual*, (and moſt of all at F;) and in the other part, which is from the Sun, as G D E, it doth increaſe it, (and moſt of all at D.) that is, in the day time there is abated, in the night time is added to the *Annual* motion, about as much as is G E, the Earths *Diameter*. Which would afford us a Cauſe of two Tides in twenty four hours; the One upon the greateſt Acceleration of motion, the Other upon its greateſt Retardation.

And thus far *Galilæo*'s Diſcourſe holds well enough; But then in

in this it comes ſhort; that as it gives an Account of two Tides: ſo thoſe two Tides are alwayes to be at F and D; that is, at *Noon* and *Midnight*; whereas Experience tells us, that the Time of Tides, moves in a *moneths ſpace* through all the 24. hours. Of which he gives us no account. For though he do take notice of a Menſtrual Period; yet he doth it onely as to the *Quantity* of the Tides; greater or leſs; not as to the *Time* of the *Tides*, ſooner or later.

To help this, there is one (*Vid.* * *Jo. Baptiſta Balianus*) who makes the *Earth* to be but a *ſecondary* Planet; and to move, not directly about the Sun, but about the Moon, the Moon meanwhile moving about the Sun; in like manner as we ſuppoſe the Earth to move about the Sun, and the Moon about it.

* *Vid. Riccioli Almageſt. novum*, Tom. 1. lib. 4. cap. 10. n. 111. pag. 216. 2.

But this, though it might furniſh us with the foundation of a *Menſtrual* Period of Accelerations and Retardations in the compound motion of ſeveral parts of the Earths ſurface; yet I am not at all inclined to admit this as a *true Hypotheſis*, for divers Reaſons, which if not demonſtrative, are yet ſo conſonant to the general Syſteme of the World, as that we have no good ground to disbelieve them. For 1. The Earth being undeniably the greater Body of the two (whereof there is no doubt to be made) it cannot be thought probable, that this ſhould be carried about by the Moon, leſſer than it ſelf: The contrary being ſeen, not onely in the *Sun*, which is bigger than any of the Planets, which it carryes about; but in *Jupiter*, bigger than any of his *Satellites*; and *Saturne*, bigger than his. 2. As the *Sun* by it's motion about it's own Axis, is with good reaſon judged to be the *Phyſical* cauſe of the *Primary* Planets moving about it; So there is the like reaſon to believe, that *Jupiter* and *Saturne* moving about their Axes, are the Phyſical cauſe of their *Satellites* moving about them, which motion of *Jupiter* hath been of late diſcover'd, by the help of a *fixed* Spot diſcern'd in him; and we have reaſon to believe the like of *Saturne*. Whether *Venus* and *Mercury* (about whom no *Satellites* have been yet obſerved) be likewiſe ſo moved; we have not yet the like ground to determine: But we have of *Mars*; from the

the Obſervations of Mr. *Hook* made in *February* and *March* laſt, and by him communicated to the *Royal Society*, and ſince Printed in the *Tranſactions*, publiſhed *Apr.* 2. 1666. conſonant to the like obſervations of *Jupiter*, made by him in *May*. 1664, and ſince communicated to the ſame *Society*; and then publiſhed in the *Tranſactions*, of *March.* 6. then next following. Now that the Earth hath ſuch a motion about its own Axis (whereby it might be fitted to carry about the Moon) is evident by its *Diurnal* motion. And it ſeems as evident that the Moon hath not; becauſe of the ſame ſide of the Moon alwaies turned towards us; which could not be, if the Moon carried the Earth about: Unleſſe we ſhould ſay, that it carries about the Earth in juſt the ſame Period, in which it turnes upon its own Axis: Which is contrary to that of the Sun carrying about the Planets: the ſhorteſt of whoſe Periods, is yet longer than that of the Suns moving about its own Axis. And the like of *Jupiter*, ſhorter than the Period of any of his *Satellites*; if at leaſt the Period of his converſion about his Axis, lately ſaid to be obſerved, prove true. (Of *Saturn* we have not yet any Period aſſigned; but it's likely to be ſhorter, than that of his *Satelles*.) And therefore we have reaſon to believe, not that by the Moons motion about its Axis the Earth ſhould be carried by a contemporary Period (whereby the ſame face of the Moon ſhould be ever towards us;) but that by the Earths revolution abouts its Axis in 24. hours, the Moon ſhould be carried about it in about 29. dayes, without any motion on its own Axis: And accordingly, that the *Secondary* Planets about *Jupiter* and *Saturn*, are not (like their *Principals*) turned about their own Axis. And therefore I am not at all inclined to believe, that the *Menſtrual* Period of the Tides with us, is to be ſalved by ſuch an Hypotheſis.

In ſtead of this, that *Surmiſe* of mine, (for I dare not yet, with confidence g ve it any better name,) of what I have ſpoken to you heretofore, (and which hath occaſioned this preſent account which I am now giving you,) is to this purpoſe.

The Earth and Moon being known to be Bodies of ſo great connexion (whether by any Magnetick, or what other Tye, I will not determine; nor need I, as to this purpoſe;) as that

the motion of the one follows that of the other; (The Moon observing the Earth as the Center of its *periodick* motion:) may very well enough be looked upon as *one Body*, or rather *one Aggregate of Bodies*, which have *one common center of Gravity*; which Center (according to the known Laws of *Staticks*) is in a streight Line connecting their respective Centers, so divided as that its parts be in reciprocal proportion to the Gravities of the two Bodies. As for Example; Suppose the Magnitude (and therefore probably the Gravity) of the Moon to be about an *One and fourtieth part* of that of the Earth; (and thereabouts *Hevelius* in his *Selenography* page 203. doth out of *Tycho*, estimate the proportion; and an exact certainty is not necessary to our present businesse.) And the distance of the Moons Center from the Center of the Earth, to be about *fifty six semidiameters* of the Earth, (as thereabouts he doth there estimate it, in its middle distance; and we need not be now very accurate in determining the numbers; wherein Astronomers are not yet very well agreed.) The distance of the Common Center of Gravity of the two Bodies, will be from that of the Earth, about a two and fourtieth part of fifty six Semidiameters; that is, about $\frac{56}{42}$ or $\frac{4}{3}$ of a Semidiameter; that is about $\frac{1}{3}$ of a Semidiameter of the Earth, above its surface, in the Air, directly between the Earth and Moon.

Now supposing the Earth and Moon, joyntly as one Body, carried about by the Sun in the great Orb of the *Annual* motion; this motion is to be estimated, (according to the Laws of *Staticks*, in other cases,) by the motion of the common Center of Gravity of both Bodies. For we use in *Staticks*, to estimate a Body, or Aggregate of Bodies, to be moved upwards, downwards, or otherwise, so much as its Common Center of Gravity is so moved, howsoever the parts may change places amongst themselves.

And accordingly, the Line of the *Annual* motion, (whether *Circular* or *Elliptical*; of which I am not here to dispute,) will be described, not by the Center of the Earth (as we commonly estimate it, making the Earth a Primary and the Moon a Secondary Planet,) nor by the Center of the Moon, (as they would do, who make the Moon the Primary and the Earth a Secondary

Secondary Planet, againſt which we were before diſputing:) But by the *Common Center of Gravity of the Bodies, Earth and Moon*, as one Aggregate.

Now ſuppoſing A B C D E to be a part of the great Orb of the *Annual* motion, deſcribed by the Common Center of Gravity, in ſo long time as from a *Full-Moon* at A to the next *New-Moon* at E; (which, though an Arch of a *Circle* or *Ellipſe*, whoſe Center we ſuppoſe at a due diſtance below it; yet being but about $\frac{1}{25}$ of the whole, may well enough be here repreſented by a ſtreight Line:) the Center of the Earth at T, and that of the Moon at L, muſt each of them (ſuppoſing their common Center of Gravity to keep the Line A E) be ſuppoſed to deſcribe a *Periphery* about that Common Center, as the Moon deſcribes her Line of *Menſtrual* motion. (Of which I have (in the *Scheme*) onely drawn that of the *Earth*; as being ſufficient to our preſent purpoſe; parallel to which, if need be, we may ſuppoſe one deſcribed by the Moon; whoſe diſtance is alſo to be ſuppoſed much greater from T than in the *figure* is expreſſed, or was neceſſary to expreſſe.) And in like manner E F G H I, from that *New-moon* at E, to the next *Full-moon* at I. See Fig. 2. and 3.

From A to E (from Full-moon to New-moon,) T moves (in its own *Epicycle*) upwards from the Sun: And from E to I, (from New-moon to Full-moon) it moves downwards, toward the Sun. Again, from C to G, (from laſt quarter to the following firſt quarter,) it moves *forwards according* to the *Annual* motion; But from G forward to C, (from the firſt Quarter to the enſuing laſt Quarter,) it moves *contrary* to the *Annual* motion.

It is manifeſt therefore, according to this Hypotheſis, that from Laſt quarter to Firſt quarter (from C to G, while T is above the Line of the *Annual* motion) its *Menſtrual* motion in its Epicycle *adds* ſomewhat of Acceleration to the *Annual* motion; and moſt of all at E, the New-moon: And from the firſt to the laſt quarter (from G forward to C, while T is below the Line of the *Annual* motion,) it *abates* of the *Annual* motion; and moſt of all at I, or A the Full-moon.

So that in purſuance of *Galilæo's* Notion, the *Menſtrual* add-

ing to or detracting from the *Annual* motion, ſhould either leave behinde, or caſt forward, the looſe waters incumbent on the Earth, (and thereby cauſe a Tide, or accumulation of Waters;) and moſt of all at the Full moon and New-moon, where thoſe Accelerations or Retardations are greateſt.

Now this *Menſtrual* motion, if nothing elſe were ſuperadded to the *Annual*, would give us two Tides in a moneth, and no more; (the one upon the Acceleration, the other on the Retardation;) at New-moon and Full-moon; and two Ebbs, at the two Quarters; and in the Intervals, Riſing and Falling water.

But the *Diurnal* motion ſuperadded, doth the ſame to this *Menſtrual*, which *Galilæo* ſuppoſeth is to do to that *Annual*; that is, doth *Add* to, or *Subſtract* from, the *Menſtrual* Acceleration or Retardation; and ſo gives us Tide upon Tide.

See Fig. 4. For in whatſoever part of its Epicycle, we ſuppoſe T to be; yet becauſe, while by its *Menſtrual* motion the Center moves in the Circle L T N; each point in its ſurface, by its diurnal motion moves in the Circle L M N: whatever effect (accelerative or tardative) the *Menſtrual* would give, that effect by the *Diurnal* is increaſed in the parts L M N (or rather l M n. the Semicircle) and moſt of all at M: but diminiſhed in the parts N O L (or rather n O l) and moſt of all at O. So that at M, and O, (that is when the *Moon* is in the *Meridian* below or above the *Horizon*;) we are to have the Diurnal Tide or High-water, occaſioned by the greateſt Acceleration or Retardation, which the *Diurnal* Arch gives to that of the *Menſtrual:* which ſeems to be the true cauſe of the *Daily Tides*. And withall gives an account, not onely why it ſhould be *every* day; but likewiſe, why at *ſuch a time* of the day; and why this time ſhould in a moneth run through the whole 24. hours; *viz.* becauſe the Moons coming to the *Meridian* above and below the *Horizon*, (or as the Seamen call it, the *Moons Southing*, and *Northing*,) doth ſo: As likewiſe of the *Spring tides* and *Neap-tides*. For, when it ſo happens, that the *Menſtrual* and *Diurnal* Accelerations or Retardations, be coincident, (as at New moons and Full-moons they are,) the effect muſt needs be the greater. And although (which is not to be diſſembled) this happen

but

but to one of the two Tides; that is, the Night-tide at the New-moon (when both motions do moſt of all Accelerate,) and the Day-tide at Full-moon (when both do moſt Retard the *Annual* motion;) Yet, this tide being thus raiſed by two concurrent cauſes; though the next Tide have not the ſame cauſe alſo, the *Impetus* contracted will have influence upon the next Tide; Upon a like reaſon, as a *Pendulum* let fall from a higher Arch, will (though there be no new cauſe to occaſion it) make the Vibration on the other ſide (beyond the Perpendicular) to be alſo greater: Or, of water in a broad Veſſel, if it be ſo jogged, as to be caſt forward to a good height above its Levell, will upon its recoyling, by its own gravity, (without any additional cauſe) mount ſo much the higher on the hinder part.

But here alſo we are to take notice, that though all parts of the Earth by its *Diurnal* motion do turn about its Axis, and deſcribe *parallel* Circles; yet not *equal* Circles; but *greater* neer the *Æquinoctial*, and *leſſer* near the *Poles*, which may be a cauſe why the Tides in ſome parts may be much greater than in others. But this belongs to the *particular* conſiderations, (of which we are not now giving an Account:) not to the *general* Hypotheſis.

Having thus endeavoured to give an account of the *Diurnal* and *Menſtrual* Periods of Tides; It remains that I endeavour the like as to the *Annual*. Of which there is, at leaſt, thus much agreed; That, at ſome times of the year, the Tides are noted to be much higher, than at other times.

But here I have a double task; *Firſt*, to rectify the Obſervation; and *then*, to give an account of it.

As to the *Firſt*; It having been obſerved (groſly) that thoſe high Tides have uſed to happen about the *Spring* and *Autumn*; it hath been generally taken for granted (without any more nice obſervation) that the *two Æquinoxes* are the proper times, to which theſe *Annual high Tides* are to be referred; And ſuch cauſes ſought for, as might beſt ſute with ſuch a Suppoſition.

But it is now, the beſt part of twenty years, ſince I have had frequent occaſions to converſe with ſome Inhabitants of *Rumney-marſh* in *Kent*; where the Sea being kept out with great Earthen walls, that it do not at high-water overflow the Levell;

and

and the Inhabitants livelyhood depending moſt on grazing, or feeding Sheep; they are (as you may believe they have reaſon to be) very vigilant and obſervant, at what times they are moſt in danger of having their Lands drowned. And I find them generally agreed, by their conſtant Obſervations, (and Experience dearly bought) that their times of danger are about the beginning of *February* and of *November*: that is, at thoſe Spring Tides which happen near thoſe times; to which they give the names of *Candlemaſs-ſtream* and *Allhallond-ſtream*: And if they ſcape thoſe Spring-tides, they apprehend themſelves out of Danger for the reſt of the year. And as for *March* and *September* (the two *Æquinoxes*) they are as little ſolicitous of them, as of any other part of the year.

This, I confeſs, I much wondred at, when I firſt heard it; and ſuſpected it to be but a miſtake of him, that firſt told me, though he were indeed a perſon not likely ſo to be miſtaken, in a thing wherein he was ſo much concerned: But I ſoon found, that it was not onely his, but a general obſervation of others too; both there, and elſewhere along the Sea coaſt. And though they did not pretend to know any reaſon of it, (nor ſo much as to enquire after it;) Yet none made doubt of it; but would rather laugh at any that ſhould talk of *March* and *September*, as being the dangerous times. And ſince that time, I have my ſelf very frequently obſerved (both at *London* and elſewhere, as I have had occaſion) that in thoſe months of *February* and *November*, (eſpecially *November*) the Tides have run much higher, than at other times: Though I confeſs, I have not been ſo diligent to ſet down thoſe Obſervations, as I ſhould have done. Yet this I do particularly very well remember, that in *November* 1660. (the ſame year that his Majeſty returned) having occaſion to go by Coach from the *Strand* to *Weſtminſter*, I found the Water ſo high in the middle of *King-ſtreet*, that it came up, not onely to the *Boots*, but into the *Body* of the Coach; and the *Pallace-yard* (all ſave a little place near the *Weſt-End*) overflow'd; as likewiſe the Market-place; and many other places; and their Cellars generally filled up with Water. And in *November* laſt, 1665. it may yet be very well remembred, what very high Tides there were, not onely on the Coaſts of *England*, (where much hurt was done

done by it) but much more in *Holland*, where by reaſon of thoſe Inundations, many Villages and Towns were overflow'd. And though I cannot ſo particularly name other years, yet I can very ſafely ſay, that I very often obſerved Tides ſtrangely high about thoſe times of the year.

This Obſervation did for divers years cauſe me much to wonder, not only becauſe it is ſo contrary to the received opinion of the two *Æquinoxes*; but becauſe I could not think of any thing ſignal at thoſe times of the year: as being neither the two *Æquinoxes*, nor the two *Solſtices*, nor the Sun's *Apogæum* and *Perigæum*; (or Earths *Aphelium* and *Perihelium*;) nor indeed, at contrary times of the year, which at leaſt, would ſeem to be expected. From *Alhollandtide* to *Candlemaſs* being but three months; and from thence to *Alhollandtide* again nine months.

At length it came into my mind, about four years ſince, that though there do not about theſe times happen any *ſingle* ſignal Accident, which might caſt it on theſe times, yet there is a *compound of two* that may do it: Which is the *Inequality* of the *Natural day* (I mean that of 24. hours, from noon to noon) ariſing at leaſt from a double cauſe; either of which ſingly would caſt it upon other times, but both joyntly on thoſe.

It's commonly thought, how unequal ſoever the length be of the *Artificial* dayes as contradiſtinguiſhed to nights, yet that the *Natural* Day, reckoning from noon to noon, are all *equal*: But *Aſtronomers* know well, that even theſe dayes are *unequal*.

For, this *Natural* Day is meaſured *not onely* by one intire converſion of the *Æquinoctial*, or 24. *Æquinoctial* hours, (which is indeed taken to be performed in equal times,) *but* increaſes by ſo much, as anſwers to that part of the *Sun's* (or *Earths*,) Annual motion as is performed in that time. For, when that part of the *Æquinoctial*, which (with the *Sun*) was at the *Meridian* yeſterday at noon, is come thither again to day, it is not yet *Noon* (becauſe the Sun is not now at the place where yeſterday he was, but is gone forward about one degree, more or leſs) but we muſt ſtay till that place, where the *Sun* now is, comes to the *Meridian* before it be now *Noon*.

Now this Additament (above the 24 *Æquinoctial* hours, or intire converſion of the *Æquinoctial*) is upon a double account unequal;

qual. *Firſt*, becauſe the Sun, by reaſon of its *Apogæum* and *Perigæum*, doth not at all times of the year diſpatch in one day an equal Arch of the *Ecliptick*; but greater Arches neer the *Perigæum*, which is about the middle of *December*; and leſſer neer the *Apogæum*, which is about the middle of *June*: As will appear ſufficiently by the *Tables* of the Sun's Annual motion. *Secondly*, though the Sun ſhould in the *Ecliptick* move alwaies at the ſame rate; yet equal Arches of the *Ecliptick* do not in all parts of the *Zodiack* anſwer to equal Arches of the *Æquinoctial*, by which we are to eſtimate time: Becauſe ſome parts of it, as about the two *Solſticial* Points, lie nearer to a *parallel* poſition to the *Æquinoctial*, than others, as thoſe about the two *Æquinoctial* points, where the *Ecliptick* and *Æquinoctial* do interſect; whereupon an Arch of the *Ecliptick*, neer the *Solſticial* points anſwers to a greater Arch of the *Æquinoctial*, than an Arch equal thereunto neer the *Æquinoctial* points: As doth ſufficiently appear by the *Tables* of the Suns *right Aſcenſion*.

According to the *firſt* of theſe cauſes, we ſhould have the longeſt *natural* daies in *December*, and the ſhorteſt in *June*, which if it did operate alone, would give us at thoſe times two *Annual* High-waters.

According to the *ſecond* cauſe, if operating ſingly, we ſhould have the longeſt daies at the two Solſtices in *June* and *December*, and the two ſhorteſt at the *Æquinoxes* in *March* and *September*; which would at thoſe times give occaſion of four *Annual* High-waters.

But the true *Inequality* of the Natural Days, ariſing from a *Complication of thoſe two cauſes*, ſometimes croſſing and ſometimes promoting each other: though we ſhould find ſome increaſes or decreaſes of the *Natural* daies at all thoſe ſeaſons anſwerable to the reſpective cauſes (and perhaps of Tides proportionably thereunto:) yet the longeſt and ſhorteſt *natural daies* abſolutely of the whole year (ariſing from this complication of Cauſes) are about thoſe times of *Allhallontide* and *Candlemas*; (or not far from them) about which thoſe *Annual* High-tides are found to be: As will appear by the *Tables of Æquation* of *Natural* daies. And therefore I think, we may with very good reaſon caſt this *Annual* Period upon that cauſe, or rather complication

plication of cauſes. For (as we before ſhewed in the *Menſtrual* and *Diurnal*) there will, by this inequality of Natural daies, ariſe a *Phyſical* Acceleration and Retardation of the Earths *Mean* motion, and accordingly a caſting of the Waters backward or forward; either of which, will cauſe an Accumulation or High-water.

'Tis true, that theſe longeſt and ſhorteſt daies, do (according to the *Tables*, ſome at leaſt) fall rather before, than after *Allhallontide* and *Candlemas* (to wit the ends of *October* and *January*;) but ſo do alſo (ſometimes) thoſe high Tydes: And it is not yet ſo well agreed amongſt *Aſtronomers*, what are all the Cauſes (and in what degrees) of the Inequality of Natural daies; but that there be diverſities among them, about the true time: And whether the introducing of this New Motion of the Earth in its *Epicycle* about this Common Center of *Gravity*, ought not therein alſo to be accounted for, I will not now determine: Having already ſaid enough, if not too much, for the explaining of this general Hypotheſis, leaving the particularities of it to be adjuſted according to the true meaſures of the motions; if the General Hypotheſis be found fit to be admitted.

Yet this I muſt add', (that I be not miſtaken) that whereas I caſt the time of the daily Tydes to be at all places, when the Moon is there in the *Meridian*; it muſt be underſtood of *open* Seas, where the water hath ſuch free ſcope for its motions, as if the whole Globe of Earth were equally covered with water: Well knowing, that in *Bayes* and *In-land-Channels*, the poſition of the Banks and other like cauſes muſt needs make the times to be much different from what we ſuppoſe in the open Seas: And likewiſe, that even in the Open Seas, *Iſlands*, and *Currents*, *Gulfs* and *Shallows*, may have ſome influence, though not comparable to that of *Bays* and *Channels*. And moreover, though I think, that Seamen do commonly reckon the time of High-water in the *Open* Seas, to be then, when the Moon is there in the *Meridian* (as this Hypotheſis would caſt it:) Yet I do not take my ſelf to be ſo well furniſhed with a *Hiſtory of Tides*, as to aſſure my ſelf of it; much leſs to accommodate it to particular places and caſes.

Having thus diſpatched the main of what I had to ſay con-

cerning the Seas Ebbing and Flowing: Had I not been already too tedious, I ſhould now proceed to give a further reaſon, why I do introduce this conſideration of the *Common Center of Gravity* in reference to *Aſtronomical Accounts*. For indeed, that which may poſſibly ſeem at firſt to be an Objection *againſt* it, is with me one reaſon *for* it.

It may be thought perhaps, that if the Earth ſhould thus deſcribe an *Epicycle* about the Common Center of Gravity, it would (by this its change of place) diſturbe the *Cæleſtial* motions; and make the *apparent* places of the Planets, eſpecially ſome of them, different from what they would otherwiſe be. For though ſo ſmall a removal of the Earth, as the *Epicycle* would cauſe (eſpecially if its *Semidiameter* ſhould not be above $1\frac{1}{3}$ of the Earths Semidiameter) would ſcarce be ſenſible (if at all) to the remoter Planets; yet as to the nearer it might.

Now though what *Galilæo* anſwers to a like Objection in his *Hypotheſis*; (that its poſſible there may be ſome ſmall difference, which *Aſtronomers* have not yet been ſo accurate, as to obſerve) might here perhaps ſerve the turn; Yet my anſwer is much otherwiſe; to wit, that ſuch difference hath been obſerved, and hath very much puzzeled *Aſtronomers* to give an account of. About which you will find Mr, *Horrocks* (in ſome of his Letters, whereof I did formerly, upon the Command of the *Royal Society*, make an *Extract*) was very much perplexed; and was fain, for want of other relief, to have recourſe to ſomewhat like *Keplers* amicable *Fibres*, which did according to the ſeveral poſitions of the Moon, accelerate or retard the Moon's motion; which *amicable Fibres* he had no affection to at all (as there appears) if he could any other waies give account of thoſe little inequalities; and would much rather (I doubt not) have embraced this Notion of the Common Center of Gravity, to ſalve the *Phænomenon*, had it come to his mind, or been ſuggeſted to him. And you find, that other *Aſtronomers* have been ſeen to bring in (ſome upon one ſuppoſition, ſome upon another) ſome kind of *Menſtrual Æquation*, to ſolve the inequalities of the Moon's motion, according to her *Synodical* Revolution, or different Aſpects (of New-moon, Full Moon, &c.) beſide what concerns her own *Periodical* motion.

For

For which, this conſideration of the *Common Center of Gravity of the Earth and Moon*, is ſo proper a remedy (eſpecially if it ſhall be found preciſely to anſwer thoſe *Phænomena*, which I have not Examined, but am very apt to believe) that it is ſo far from being, with me, an Objection againſt it, that it is one of the reaſons, which make me inclinable to introduce it.

I muſt before I leave this, add one Conſideration more, That if we ſhall upon theſe Conſiderations think it reaſonable, thus to conſider the *Common Center of Gravity of the Earth and Moon*; it may as well be thought reaſonable, that the like Conſideration ſhould be had of *Jupiter* and his four *Satellites*, which according to the Complication of their ſeveral motions, will ſomewhat change the poſition of *Jupiter*, as to that *Common center of Gravity* of all theſe Bodies; which yet, becauſe of their ſmallneſs, may chance to be ſo little, as that, at this diſtance, the change of this apparent place may not be diſcernable. And what is ſaid of *Jupiter*, is in the like manner to be underſtood of *Saturne* and his *Satelles*, diſcovered by *Hugenius*: For all theſe *Satellites* are to their *Principals*, as ſo many Moons to the Earth. And I do very well remember, in the Letters forecited, Mr. *Horrocks* expreſſeth ſome ſuch little inequalities in *Saturnes* motion, of which he could not imagine what account to give, as if (to uſe his Expreſſion) this crabbed *Old Saturn* had deſpiſed his *Youth*. Which, for ought I know, might well enough have been accounted for, if at that time the *Satelles* of *Saturn* had been diſcovered, and that Mr. *Horrocks* had thought of ſuch a motion as the *Common Center of Gravity* of *Saturn* and his *Companion*, to be conſiderable, as to the guiding of his motion.

You have now, in obedience to your Commands, an Account of my thoughts, as to this matter, though yet immature and unpoliſhed: What uſe you will pleaſe to make of them, I ſhall leave to your prudence, &c.

An APPENDIX, *written by way of Letter to the* Publiſher; *Being an Anſwer to ſome Objections, made by ſeveral Perſons, to the precedent Diſcourſe.*

I Received yours; and am very well contented, that *objections* be made againſt my *Hypotheſis* concerning *Tydes*: being

propoſed but as a conjecture to be examined; and, upon that Examination, rectified, if there be occaſion; or rejected, if it will not hold water.

1. To the firſt objection of thoſe you mention; *That it appears not how two Bodies, that have no tye, can have one common Center of Gravity:* that is (for ſo I underſtand the intendment of the objection) can act or be acted in the ſame manner, as if they were connected: I ſhall onely anſwer, that it is harder to ſhew *How* they have, than *That* they have it. That the Load-ſtone and Iron have ſomewhat equivalent to a Tye; though we ſee it not, yet by the effects we know. And it would be eaſy to ſhew, that two Load ſtones, at once applyed, in different poſitions, to the ſame Needle, at ſome convenient diſtance; will draw it, not to point directly to either of them, but to ſome point between both; which point is, as to thoſe two, the *common Center of Attraction*; and it is the ſame, as if ſome *one* Load-ſtone were in that point. Yet have theſe two Load ſtones no connexion or tye, though a *Common Center of Virtue* according to which they joyntly act. And as to the preſent caſe, *How* the Earth and Moon are connected; I will not now undertake to ſhew (nor is it neceſſary to my purpoſe;) but, That there is ſomewhat, that doth connect them, (as much as what connects the Load-ſtone, and the Iron, which it draws,) is paſt doubt to thoſe, who allow them to be carryed about by the Sun, as one Aggregate or Body, whoſe parts keep a reſpective poſition to one another: Like as *Jupiter* with his *four Satellites*, and *Saturn* with his *one*. Some Tye there is, that makes thoſe *Satellites* attend their *Lords*, and move in a Body; though we do not *See* that Tye, nor *Hear* the Words of Command. And ſo here.

2. To the ſecond objection; *That, at Chatham and in the Thames, the Annual Spring-tydes, happen about the Æquinoxes; not (as this Hypotheſis doth ſuppoſe elſwhere to have been obſerved) about the begining of February and November.* If their meaning be, that Annual High Tydes, do then happen, and then onely: If this prove true, it will eaſe me of half my work. For it is then eaſily anſwered, that it depends upon the *Obliquity of the Zodiack*; the parts of the Æquinoctial anſwering to equal parts of the

Zodiack,

Zodiack, being neer the Solſtitial points greateſt, and near the Æquinoctial points leaſt of all. But beſide this *Annual Viciſſitude of the Æquinoxes*, not to ſay, of the 4. Cardinal Points (which my Hypotheſis doth allow and aſſert;) I believe it will be found, that there is *another Annual viciſſitude* anſwering to the Suns *Apogæum* and *Perigæum*. And that the greateſt Tydes of all, will be found to be upon a reſult of theſe two cauſes Co-operating: which (as doth the Inequality of Natural dayes, depending on theſe ſame cauſes) will light nearer the times, I mention. To what is ſaid to be obſerved at *Chatham* and in the *Thames*, contrary to that I allege as obſerved in *Rumney marſh*: I muſt at preſent ἀπέχειν, and refer to a *melius inquirendum*. If thoſe who object this contrary obſervation, ſhall, after this notice, find, upon new Obſervations heedfully taken, that the *Spring-tydes* in *February* and *November*, are not ſo high, as thoſe in *March* and *September*; I ſhall then think the objection very conſiderable. But I do very well remember, that I have ſeen in *November*, very high Tydes at *London*, as well as in *Rumney Marſh*. And, the time is not yet ſo far paſt, but that it may be remembered (by your ſelf or others then in *London*) whether in *November* laſt when the Tydes were ſo high at *Dover*, at *Deal*, at *Margate*, and all along the Coaſt from thence to *Rumney Marſh*, as to do in ſome of thoſe places much hurt, (and, in *Holland*, much more;) whether, I ſay, there were not alſo at the ſame time, at *London*, (upon the *Thames*) very high Tydes. But a good *Diary* of the Height and time both of High-water, and Low-water, for a year or two together, even at *Chatham*, or *Greenwich*; but rather at ſome place in the *open* Sea, or at the *Lands end* in *Cornwal*, or on the *Weſt parts of Ireland*; or at St. *Hellens*, or the *Bermodas*, &c. would do more to the reſolving of this point, than any verbal diſcourſe without it.

3. To the third Objection, *That ſuppoſing the Earth and Moon to move about a Common center of gravity; if that the higheſt Tydes be at the New-moon, when the moon being neareſt to the Sun, the Earth is fartheſt from it, and its compound motion at the ſwifteſt; and that the Tydes abate as the Earth approacheth nearer, till it comes into the ſuppoſed Circle of her Annual motion: It may be demanded, why do they not ſtill abate as the Earth comes yet nearer to the Sun and the*

ſwifteſt

ſwiftneſſe of its compound motion ſtill ſlackens? And ſo, why have we not Spring tides at the New Moon (when the motion is ſwifteſt) and Neap-tides at Full Moon (when the motion is ſloweſt) but Spring tides at both? The anſwer (if obſerved) is already given in my *Hypotheſis* it ſelf. Becauſe the effect is indifferently to follow, either upon a ſuddain Acceleration, or a ſuddain Retardation. (Like as a looſe thing, lying on a moving body; if the body be thruſt ſuddainly forward, that looſe thing is caſt back, or rather left behind, not having yet obtained an equal *impetus* with that of the body, on which it lyes; but if ſtopped, or notably retarded, that looſe incumbent is thrown forward, by its formerly contracted *impetus* not yet qualified or accomodated to the ſlowneſs of the Body, on which it lyes.) Now both of theſe happening, the one at the New Moon, the other at the Full Moon, do cauſe high Tides at both.

4. To the fourth Objection, *That the higheſt Tydes are not at all places, about the New Moon and Full Moon; and particularly, that, in ſome places of the Eaſt Indies, the Higheſt Tydes are at the Quadratures*: I muſt firſt anſwer in *general*; That as to the particular varieties of Tydes in ſeveral parts of the World, I cannot pretend to give a ſatisfactory account, for want of a competent Hiſtory of Tydes, *&c.* Becauſe (as is intimated in what I wrote in the *general*) the various poſitions of Chanels, Bays, Promontories, Gulfs, Shallows, Currents, Trade-winds, *&c.* muſt needs make an innumerable variety of Accidents in particular places, of which no ſatisfactory account is to be given from the general *Hypotheſis* (though never ſo true) without a due conſideration of all thoſe. Which is a task too great for me to undertake, being ſo ill furniſhed with materials for it. And then as to the particular inſtance of ſome places in the *Eaſt Indies*, where the higheſt Tydes are at the *Quadratures*: I ſuppoſe, it may be chiefly intended of thoſe about *Cambaia*, and *Pegu*. At which places, beſide that they are ſituate at the inmoſt parts of Vaſt Bayes, or Gulfs (as they are called) they have alſo vaſt In-draughts of ſome hundred Miles within Land; which when the Tydes are out, do lye (in a manner) quite dry: And may therefore very well be ſuppoſed to participate the effect of the Menſtrual Tydes many dayes after the cauſe

cauſe of them happens in the open Sea, upon a like ground as in Straights and narrow Channels the Diurnall Tydes happen ſome hours later than in the Ocean. And a like account muſt be given of particular accidents in other places, from the particular ſituation of thoſe places, as *Bays*, *Chanels*, *Currents*, &c.

5. To the 5. Objection, *That the Spring-Tydes happen not, with us, juſt at the Full and Change, but two or three daies after.* I ſhould with the more confidence attempt an Anſwer, were I certain, whether it be ſo in the *Open* Seas, or onely in our Channels. For the Anſwers will not be the ſame in both caſes. If onely in our Channels, where the Tydes find a large in-draught; but not in the Open Seas: we muſt ſeek the reaſon of it from the particular poſition of theſe places. But if it be ſo generally in the wide Open Seas: We muſt then ſeek a reaſon of it from the general Hypotheſis. And, till I know the matter of Fact, I know not well, which to offer at; leſt whilſt I attempt to ſalve one, I ſhould fall foul of the other. I know that Marriners uſe to ſpeak of Spring-Tydes at the New and Full of the Moon; though I have ſtill had a ſuſpition that it might be ſome daies after, as well in the open Seas, as in our narrower Channels; (and therefore I have choſen to ſay, in my Papers, *About* the New and Full, rather than *At* the New and Full; and even when I do ſay *At*, I intend it in that laxer ſenſe in which I ſuppoſe the Marriners are to be underſtood, for *Neer* that time:) Of which ſuſpition you will find ſome intimations even in my firſt Papers: But this though I can admit; yet, becauſe I was not ſure of it, I durſt not build upon it. The truth is, the Flux and Reflux of water in a veſſel, by reaſon of the jogging of it; though it follow thereupon; yet is, for the moſt part, diſcernable ſome time after. For there muſt, upon that jog, be ſome time for Motion, before the Accumulation can have made a Tyde. And ſo I do not know but that we muſt allow it in all the Periods. For as the *menſtrual* High Tyde, is not (at leaſt with us) till ſome Daies after the Full and Change; ſo is the *Diurnal* High water, about as many Hours after the Moons comming to South; (I mean, At Sea: for in Chanels it varies to all Hours, according as they are neerer or further from the open Sea:) And the *Annual* High-Tydes of *November* and *February*; ſomewhat later than

(what

(what I conjecture to be from the ſame cauſes) the greateſt Inequalities of the natural Days, happening in *January* and *October*. But this though I can admit, yet (till I am ſure of the matter of Fact) I do not build upon. And ſince it hath hitherto been the cuſtome to ſpeak with that laxneſs of expreſſion; aſſigning the times of New-moon, Full-moon, and Quadratures, with the Moons comming to South, for, what is neer thoſe times: I did not think my ſelf obliged in my conjectural Hypotheſis (while it is yet but a *Candidate*) to ſpeak more nicely. If the Hypotheſis for the maine of it be found Rational; the Niceties of it are to be adjuſted, in time, from particular Obſervation.

Having thus given you ſome Anſwers to the Objections you ſignifie to have been made by ſeveral perſons to my Hypotheſis, and that in the ſame order your Paper preſents them to me: I ſhall next give you ſome account of the two *Books*, which you adviſed me to conſult; ſo far as ſeems neceſſary to this buſineſs: Which, upon your intimation, I have ſince peruſed, though before I had not.

And firſt, as to that of *Iſaac Voſſius*, *De motu Marium & Ventorum*; Though I do not concur with him in his Hypotheſis; That all the *Great motions of the Seas*, &c. ſhould ariſe onely from *ſo ſmall a warming of the water* as to raiſe it (where moſt of all) *not a Foot* in perpendicular, (as in his 12*th* Chapter;) Or that there is no other connexion between the Moons motion, and the Tydes *menſtrual* period, than a *caſual Synchroniſm* (which ſeems to be the doctrine of his 16*th* and 18*th* Chapters;) Beſide many other things in his Philoſophy, which I cannot allow: Yet I am well enough pleaſed with what is Hiſtorical in it, of the matter of Fact: Eſpecially if I may be ſecure, that he is therein accurate and candid, not wreſting the *Phænomena* to his own purpoſe. But I find nothing in it, which doth induce me to vary from my Hypotheſis. For, granting his Hiſtoricals to be all true; the account of the conſtant Current of the Sea Weſtward, and of the conſtant Eaſtern Blaſts, &c. within the *Tropicks*, is much more plauſibly, and (I ſuppoſe) truly rendered by *Galilæo* long ſince, from the Earths *Diurnal* motion: (which, neare the *Æquator*. deſcribing a greater Circle, than nearer the *Poles*,

Poles, makes the Current to be there more conſpicuous and ſwift, and, conſequently, the Eddy, or recurrent motion, nearer the Poles, where this is, more remiſs:) than can eaſily be rendered by ſo ſmall a Tumor, as he ſuppoſeth. Not to adde; that his account of the Progreſſive motion, which he fanſieth to follow upon this Tumefaction, and by Acceleration to grow to ſo great a height near the Shoar (as in Chap. 13. and 14.) is a Notion, which ſeems to me too extravagant to be ſalved by any laws of *Staticks*. And that of the Moons motion onely Synchronizing with the Tydes, caſually, without any *Phyſical* connexion; I can very hardly aſſent to. For it can hardly be imagined, that any ſuch conſtant *Synchroniſme* ſhou'd be in Nature; but where, either the one is the cauſe of the other, or both depend upon ſome *Common* cauſe. And where we ſee ſo fair a foundation for a *Phyſical* connection. I am not prone to aſcribe it to an Independent Synchroniſm. In ſum; His Hiſtory doth well enough agree with my Hypotheſis; and I think, the Phænomena are much better ſalved by mine, than his.

And then as to *Gaſſendus*, in his diſcourſe *De Æſtu Maris*, I find him, after the relating of many other Opinions concerning the Cauſe of it, inclining to that of *Galilæo*, aſcribing it to the Acceleration & Retardation of the Earths motion, compounded of the Annual and Diurnal; And moreover attempting to give an account of the *Menſtrual Periods* from the Earths carrying the Moon about it ſelf, as *Jupiter* doth his *Satellites*; which together with them is carryed about by the *Sun*, as one Aggregate; (and that the Earth with its Moon is to be ſuppoſed in like manner to be carried about by the Sun, as one Aggregate, cannot be reaſonably doubted, by thoſe who entertain the *Copernican Hypotheſis*, and do allow the ſame of *Jupiter* and his *Satellites*.) But though he would thus have the Earth and Moon looked upon as two parts of the ſame moved Aggregate, yet he doth ſtill ſuppoſe (as *Galilæo* had done before him) that the line of the Mean Motion of this Aggregate (or, as he calls, *motus æquabilis et veluti medius*) is deſcribed by the *Center* of the *Earth* (about which Center he ſuppoſeth both its own revolution to be made, and an Epicycle deſcribed by the Moons motion;) nor by another Point, diſtinct from the Centers of both, about which as the

common Center of Gravity, as well that of the Earth, as that of the Moon, are to deſcribe ſeveral Epicycles. And, for that Reaſon fails of giving any clear account of this *Menſtrual* Period. (And in like manner, he propoſeth the Conſideration as well of the Earths *Aphelium* and *Perihelium*, as of the *Æquinoctial* and *Solſtitial* Points, in order to the finding a Reaſon of the *Annual* Viciſſitudes; but doth not fix upon any thing, in which himſelf can Acquieſce: And therefore leaves it *in medio* as he found it.)

It had been more agreeable to the Laws of *Staticks*, if he had, (as I do,) ſo conſidered the *Earth* and *Moon* as two parts of the ſame movable, (not ſo, as he doth, *aliam in Centro et ſequente præciſe revolutionem axis, aliam remotius ac velut in circumferentia*, but,) ſo, as to make neither of them the Center, but both out of it, deſcribing Epicycles about it: Like as, when a long ſtick thrown in the Air, whoſe one end is heavyer than the other, is whirled about, ſo as that the End, which did firſt fly foremoſt, becomes hindmoſt; the proper line of motion of this whole Body is not that, which is deſcribed by either End, but that, which is deſcribed by a middle point between them; about which point each end, in whirling, deſcribes an Epicycle. And indeed, in the preſent caſe, it is not the Epicycle deſcribed by the Moon, but that, deſcribed by the Earth, which gives the *Menſtrual* Viciſſitudes of motion to the Water; which would, as to this, be the ſame, if the Earth ſo move, whether there were any Moon to move or not; nor would the Moons Motion, ſuppoſing the Earth to hold on its own courſe, any whit concern the motion of the Water.

But now, (after all our Phyſical, or Statical Conſiderations) the cleareſt Evidence for this Hypotheſis (if it can be had) will be from Celeſtial Obſervations. As for inſtance; (ſee *Fig.* 5.) Suppoſing the Sun at S; the Earths place in its Annual Orb at T; and *Mars* (in oppoſition to the Sun, or near it) at M: From whence *Mars* ſhould appear in the Zodiack at γ, and will at Full moon be ſeen there to be; the Moon being at C and the Earth at c: (and the like at the New-moon.) But if the Moon be in the Firſt quarter at A, and the Earth at a; *Mars* will be ſeen, not at γ, but at α; too ſlow: And when the Moon is at B, and the Earth at b, *Mars* will be ſeen at β; yet too ſlow: till at the Full-

moon,

moon, the Moon at C, the Earth at c, *Mars* will be ſeen at γ, its true place, as if the Earth were at T. But then, after the Full, the Moon at D, the Earth at d; *Mars* will be ſeen, not at γ, but at δ; too forward: and yet more, when the Moon (at the laſt Quarter) is at E, the Earth at e, and *Mars* ſeen at ε. If therefore *Mars* (when in oppoſition to the Sun) be found (all other allowances being made) ſomewhat too backward before the Full moon, and ſomewhat too forward after the Full-moon, (and moſt of all, at the Quadratures:) it will be the beſt confirmation of the Hypotheſis. (The like may be fitted to *Mars* in other poſitions, *mutatis mutandis*; and ſo for the other Planets.)

But this proof, is of like nature as that of the Parallaxis of the Earths Annual Orb to prove the Copernican Hypotheſis. If it can be obſerved, it proves the Affirmative; but if it cannot be obſerved, it doth not convince the Negative, but only proves that the Semidiameter of the Earths Epicycle is ſo ſmall as not to make any diſcernable Parallax. And indeed, I doubt, that will be the iſſue. For the Semidiameter of this Epicycle, being little more than the Semidiameter of the Earth it ſelf, or about $1\frac{1}{3}$ thereof (as is conjectured, in the *Hypotheſis*, from the Magnitudes and Diſtances of the Earth and Moon compared;) and there having not as yet been obſerved any diſcernable *Parallax* of *Mars*, even in his neereſt poſition to the Earth; it is very ſuſpicious, that here it may prove ſo too. And whether any of the other Planets will be more favourable in this point, I cannot ſay.

ANIMADVERSIONS
of Dr. Wallis, *upon Mr.* Hobs's *late Book*, De Principiis & Ratiocinatione Geometrarum.

Theſe were communicated by way of Letter, written in *Oxford*, July 24. 1666. to an Acquaintance of the *Author*, as follows:

SInce I ſaw you laſt, I have read over Mr. *Hobs*'s Book *Contra Geometras* (or *De Principiis & Ratiocinatione Geometrarum*) which you then ſhewed me. A *New* Book of *Old* matter: Containing but a *Repetition* of what he had before told us, more than once; and which hath been Anſwered long agoe.

In which, though there be Faults enough to offer ample mat-

ter for a large Confutation: yet I am ſcarce inclined to believe, that any will beſtow ſo much pains upon it. For, if that be true, which (in his *Preface*) he ſaith of himſelf, *Aut ſolus inſanio Ego, aut ſolus non inſanio:* it would either be *Needleſs*, or *to no Purpoſe*. For, by his own confeſſion, *All others*, if they be not mad themſelves, ought to think *Him* ſo: And therefore, as to *Them*, a Confutation would be *needleſs*; who, its like, are well enough ſatisfied already: at leaſt out of danger of being ſeduced. And, as to himſelf, it would be *to no purpoſe*. For, if *He* be the Mad man, it is not to be hoped that he will be convinced by Reaſon: Or, if *All We* be ſo; we are in no capacity to attempt it.

But there is yet another Reaſon, why I think it not to need a Confutation. Becauſe what is in it, hath been ſufficiently confuted already; (and, ſo Effectually; as that he profeſſeth himſelf not to Hope, that *This Age* is like to give ſentence for him; what ever *Nondum imbuta Poſteritas* may do.) Nor doth there appear any Reaſon, why he ſhould again Repeat it, unleſs he can hope, That, what was at firſt Falſe, may by oft Repeating, become True.

I ſhall therefore, inſtead of a large Anſwer, onely give you a brief Account, *what is in it*; &, *where it hath been already Anſwered*.

The chief of what he hath to ſay, in his firſt 10 Chapters, againſt *Euclids* Definitions, amounts but to this, That he thinks, *Euclide* ought to have allowed his *Point* ſome *Bigneſs*; his *Line*, ſome *Breadth*; and his *Surface*, ſome *Thickneſs*.

But where in his *Dialogues*, pag. 151, 152. he ſolemnly undertakes to Demonſtrate it; (for it is there, his 41th *Propoſition:*) his Demonſtration amounts to no more but this; That, *unleſs a Line be allowed ſome Latitude; it is not poſſible that his Quadratures can be True*. For finding himſelf reduced to theſe inconveniences; 1. That his *Geometrical Conſtructions*, would not conſiſt with *Arithmetical calculations*, nor with what *Archimedes* and others have long ſince demonſtrated: 2. That the *Arch* of a Circle muſt be allowed to be ſometimes *Shorter* than its *Chord*, and ſometimes *longer* than its *Tangent*: 3. That the ſame Straight Line muſt be allowed, at one place onely to *Touch*, and at another place to *Cut* the ſame Circle: (with others of like nature;) He findes it neceſſary, that theſe things may not ſeem Abſurd, to allow his *Lines* ſome *Breadth*, (that ſo, as he ſpeaks, *While a Sraight Line with its Out-ſide doth at one place Touch*

Touch the Circle, it may with its In-ſide at another place Cut it, &c.) But I ſhould ſooner take this to be a *Confutation of His Quadratures*, than a *Demonſtration of the Breadth of a* (Mathematical) *Line*. Of which, ſee my *Hobbius Heauton-timorumenus*, from *pag.* 114. to *p.* 119.

And what he now Adds, being to this purpoſe; That though *Euclid's* Σημεῖον, which we tranſlate, *a Point*, be not indeed *Nomen Quanti*; yet cannot this be actually repreſented by any thing, but what will have ſome Magnitude; nor can *a Painter*, no not *Apelles* himſelf, draw a *Line* ſo ſmall, but that it will have ſome Breadth; nor can *Thread* be ſpun ſo Fine, but that it will have ſome Bigneſs; (*pag.* 2, 3, 19, 21.) is nothing to the Buſineſs; For *Euclide* doth not ſpeak either of ſuch *Points*, or of ſuch *Lines*.

He ſhould rather have conſidered of his own Expedient, *pag.* 11. That, when one of his (*broad*) Lines, paſſing through one of his (*great*) Points, is ſuppoſed to cut another Line propoſed, into two equal parts; we are to underſtand, the *Middle of the breadth* of that Line, paſſing through the *middle* of that Point, to diſtinguiſh the Line given into two equal parts. And he ſhould then have conſidered further, that *Euclide*, by a *Line*, means no more than what Mr. *Hobs* would call *the middle of the breadth* of his; and *Euclide's Point*, is but the *Middle* of Mr. *Hobs's*. And then, for the ſame reaſon, that Mr. *Hobs's Middle* muſt be ſaid to have no *Magnitude*; (For elſe, not the *whole Middle*, but the *Middle of the Middle*, will be *in the Middle*: And, the *Whole* will not be equal to its *Two Halves*; but Bigger than *Both*, by ſo much as the *Middle* comes to:) *Euclide's Lines* muſt as well be ſaid to have no Breadth; and his *Points* no Bigneſs.

In like manner, When *Euclide* and others do make the *Terme* or *End* of a Line, a *Point*: If this *Point* have *Parts* or *Greatneſs*, then not the *Point*, but the *Outer-Half* of this Point ends the Line, (for, that the *Inner-Half* of that Point is not at the End, is manifeſt, becauſe the *Outer-Half* is beyond it:) And again, if that *Outer Half* have *Parts* alſo; not this, but the *Outer* part of it, and again the *Outer part* of that *Outer part*, (and ſo in *infinitum*.) So that, as long as *Any thing of Line* remains, we are not yet at the *End*: And conſequently, if we muſt have paſſed the *whole Length*, before we be at the *End*; then that *End* (or *Punctum terminans*) has *nothing of Length*; (for, when the *whole Length* is paſt, there is nothing of it left. And if Mr. *Hobs* tells us (as *pag.* 3.) that this

End

End is not *Punctum*, but only *Signum* (which he does allow *non esse nomen Quanti*) even *this* will serve our turn well enough. *Euclid's* Σημεῖον, which some Interpreters render by *Signum*, others have thought fit (with *Tully*) to call *Punctum*: But if Mr. *Hobs* like not that name, we will not contend about it. Let it be *Punctum*, or let it be *Signum* (or, if he please, he may call it *Vexillum*.) But then he is to remember, that this is only a Controversie in *Grammar*, not in *Mathematicks*: And his Book should have been intituled *Contra Grammaticos*, not, *Contra Geometras*. Nor is it *Euclide*, but *Cicero*, that is concern'd, in rendring the Greek Σημεῖον, by the Latine *Punctum*, not by Mr. *Hobs's Signum*. The Mathematician is equally content with either word.

What he saith here, *Chap.* 8. & 19. (and in his fifth *Dial. p.* 105. &c.) concerning the *Angle of Contact*; amounts but to thus much, That, by the *Angle of Contact*, he doth not mean either what *Euclide* calls an *Angle*, or any thing of that kind; (and therefore says nothing to the purpose of what was in controversie between *Clavius* and *Peletarius*, when he says, that *An Angle of Contact hath some magnitude*:) But, that by the *Angle of Contact*, he understands the *Crookedness of the Arch*; and in saying, *the Angle of Contact hath some magnitude*, his meaning is, that the *Arch of a Circle hath some crookedness*, or, is a *crooked line*: and that, of equal Arches, That is the more crooked, whose chord is shortest: which I think none will deny; (for who ever doubted, but that *a circular Arch is crooked*? or, that, of such Arches, equal in length, *That is the more crooked, whose ends by bowing are brought neareſt together*?) But, why the *Crookedness of an Arch*, should be called *an Angle of Contact*; I know no other reason, but, because Mr. *Hobs* loves to call that *Chalk*, which others call *Cheese*. Of this see my *Hobbius Heauton-timorumenus*, from *pag.* 88. to *p.* 100.

What he saith here of *Rations* or *Proportions*, and their *Calculus*; for 8. Chapters together, (*Chap.* 11. &c,) is but the same for substance, what he had formerly said in his 4th. Dialogue, and elsewhere. To which you may see a full Answer, in my *Hobbius Heauton-tim.* from *pag* 49. to *p.* 88. which I need not here repeat.

Onely (as a *Specimen* of Mr. *Hobs's* Candour, in Falsifications) you may by the way observe, how he deals with a Demonstration of Mr. *Rook's*, in confutation of Mr. *Hobs's* Duplication of the Cube: Which when he had repeated, *pag.* 43. He doth then (that it might seem absurd) change those words, *æquales quatuor*

quatuor cubis DV ; (*pag.* 43. *line* 33.) into theſe (*p.* 44. *l.* 5.) *æqualia quatuor Lineis, nempe quadruplus Rectæ* DV: And would thence perſwade you, that Mr *Rook* had aſſigned a *Solide*, equal to a *Line*. But Mr. *Rook's* Demonſtration was clear enough for Mr. *Hobſe's* Comment. Nor do I know any Mathematician (unleſs you take *Mr. Hobs* to be one) who thinks that *a Line multiplyed by a Number will make a Square*; (what ever *Mr. Hobs* is pleaſed to teach us.) But, That *a Number multiplyed by a Number, may make a Square Number*; and, That *a Line drawn into a Line may make a ſquare Figure*, *Mr. Hobs* (if he were, what he would be thought to be) might have known before now. Or, (if he had not before known it) he might have learned, (by what I ſhew him upon a like occaſion, in my *Heb. Heaut. pag.* 142. 143. 144.) *How* to underſtand that Language, without an Abſurdity.

Juſt in the ſame manner he doth, in the next page, deal with *Clavius*. For having given us his words, pag. 45 l. 3. 4. *Dico hanc Lineam Perpendicularem extra circulum cadere* (becauſe neither *intra Circulum*, nor *in Peripheria*;) He doth, when he would ſhew an errour, firſt make one, by falſifying his words, *line* 15. where inſtead of *Lineam Perpendicularem*, he ſubſtitutes *Punctum A*. As if *Euclide* or *Clavius* had denyed the *Point A*. (the utmoſt point of the *Radius*,) to be in the Circumference: Or, as if Mr. *Hobs*, by proving the *Point A*, to be in the Circumference, had thereby proved, that the *Perpendicular Tangent A E* had alſo lyen in the Circumference of the Circle. But this is a Trade, which Mr. *Hobs* doth drive ſo often, as if he were as well faulty in his *Morals*, as in his *Mathematicks*.

The *Quadrature of a Circle*, which here he gives us, *Chap.* 20. 21. 23. is one of thoſe *Twelve* of his, which in my *Hobbius Heauton-timorumenus* (from *pag.* 104. to *pag.* 119) are already confuted: And is the *Ninth* in order (as I there rank them) which is particularly conſidered, *pag.* 106. 107. 108. I call it *One*, becauſe he takes it ſo to be; though it might as well be called *Two*. For, as there, ſo here, it conſiſteth of *Two branches*, which are Both Falſe; and each overthrow the other. For if the *Arch of a Quadrant* be equal to the *Aggregate of the Semidiameter and of the Tangent of* 30. *Degrees*, (as he would *Here* have it, in *Chap.* 20. and, *There*, in the cloſe of *Prop.* 27;) Then is it not equal to *that Line*, *Whoſe Square is equal to Ten ſquares of the Semiradius*, (as, *There*, he would have it, in *Prop.* 28. and, *Here*, in *Chap.* 23.) And if it be equal to *This*, then not to *That*. For *This*, and *That*, are not equal: As I then demonſtrated; and need not now repeat it.

The grand Fault of his Demonſtration (*Chap.* 20.) wherewith he would now New-vamp his old Falſe quadrature; lyes in thoſe words *Page* 49. *line* 30, 31. *Quod Impoſſibile eſt niſi* ba *tranſeat per* c. which is no impoſſibility at all. For though he firſt bid us *draw the Line R c*, and afterwards the *Line R d*: Yet, Becauſe he hath no where proved (nor is it true) that *theſe two are the ſame Line*; (that is, that the point *d* lyes in the *Line R c*, or that *R c* paſſeth through *d*:) His proving that *R d cuts off from* ab *a Line equal to the line of B c*, doth not prove, that *ab* paſſeth through *c*: For this it may well do, though *ab* lye *under* c, (vid. in caſe *d* lye beyond the line *R c*, that is, further from *A*:) or though it lye *above* c, (vid. in caſe *d* be nearer, than *R c*, to the point *A*.) And therefore, unleſs he firſt prove (which he cannot do) that *A d* (a ſixth part of *A B*) doth juſt reach to the line *R c* and no further; he onely proves

that

that a ſixth part of *ab* is *equal* to the Line of *B c*. But, whether it lye *above it*, or *below it*, or (as Mr. *Hobs* would have it) juſt *upon it*; this argument doth not conclude. (And therefore *Hugenius's* aſſertion, which Mr *Hobs*, *Chap.* 21. would here give way to this Demonſtration, doth, notwithſtanding this, remain ſafe enough.)

His demonſtration of *Chap* 23. (where he would prove, that *the aggregate of the Radius and of the Tangent of* 30. *Degrees* is equal to *a Line, whoſe ſquare is equal to* 10 *Squares of the Semiradius*;) is confuted not only by me, (in the place forecited; where this is proved to be impoſſible;) but by himſelf alſo, in this ſame Chap. *pag.* 59 (where he proves ſufficiently and doth confeſſe, that this demonſtration, and the 47. *Prop.* of the firſt of *Euclide*, cannot be both true.) But, (which is worſt of all;) whether *Euclid's* Propoſition be Falſe or True, his demonſtration muſt needs be Falſe. For he is in this Dilemma: If that Propoſition be *True*, his demonſtration is *Falſe* for he grants that they cannot be both True, *page* 59 *line* 21. 22. And again, if that Propoſition be Falſe, his Demonſtration is ſo too; for *This* depends upon *That*, *page* 55. *line* 22 and therefore muſt fall with it.

But the Fault is obvious in *His Demonſtration* (not in *Euclid's Propoſition*:) The grand Fault of it (though there are more) lyes in thoſe words, *page* 56. *line* 26. *Erit ergo M O minus quam M R* Where, inſtead of *minus*, he ſhould have ſaid *majus*. And when he hath mended that Error; he will find, that the *major* in *page* 56. *line penult*, will very well agree with *majorem* in *page* 57. *line* 1 (where the *Printer* hath already mended the Fault to his hand) and then the *Falſum ergo* will vaniſh

His Section of an Angle *in ratione data*; *Chap.* 22. hath no other foundation, than his ſuppoſed *Quadrature* of *Chap.* 20. And therefore, that being falſe; this muſt fall with it. It is juſt the ſame with that of his 6. Dialogue. *Prop.* 46. which (beſides that it wants a foundation) how abſurd it is, I have already ſhewed; in my *Hobbius Heauton timor. page* 119. 120.

His *Appendix*, wherein he undertakes to ſhew a Method of finding *any number of mean Proportionals, between two Lines given*: Depends upon the ſuppoſed Truth of his 22. Chapter; about *Dividing an Arch in any propertion given*: (As himſelf profeſſeth: and as is evident by the Conſtruction; which ſuppoſeth ſuch a Section.) And therefore, that failing, this falls with it.

And yet this is otherwiſe faulty, though *that* ſhould be ſuppoſed True For, In the firſt Demonſtration; *page* 67. *line* 12. *Producta L f incidet in I*; is not proved; nor doth it follow from his *Quoniam igitur*.

In the ſecond Demonſtration; *page* 68 *line* 34 35. *Recta L f incidit in x*; is not proved; nor doth it follow from his *Quare*.

In his third Demonſtration; *page* 71: *line* 7. *Producta Y P tranſibit per* M; is ſaid *gratis*; nor is any proof offered for it. And ſo this whole ſtructure falls to the ground. And with all, the *Prop.* 47. *El* 1 doth ſtill ſtand faſt (which he tells us, *page* 59, 61, 78. muſt have Fallen if his Demonſtrations had ſtood:) And ſo, *Geometry* and *Arithmeti* do ſtill agree, which (he tells us, *page* 78: *line* 10.) had otherwiſe been at odds.

And this (though much more might have been ſaid,) is as much as need to be ſaid againſt that Piece

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PHILOSOPHICAL TRANSACTIONS.

Munday Septemb. 9. 1666.

The Contents.

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Obſervations made in ſeveral places, Of the late *Eclipſe of the Sun*, which hapned on the 22 of *June*, 1666.

THe Obſervations that were made at *London* by Mr. *Willughby*, Dr. *Pope*, Mr. *Hook*, and Mr. *Philips*, are theſe:

The Eclipſe began at 5h. 43'

It was darkned:

	h. ′		h. ′
$\frac{1}{11}$ diam.	at 6. 00	5 dig.	at 7. 06
4 digits	at 6. 07	4 dig.	at 7. 13
5 dig.	at 6. 13	3 dig.	at 7. 20
6 dig.	at 6. 21	2 dig.	at 7. 26
7 dig.	at 6. 39½	1 dig.	at 7. 32
6 dig.	at 6. 57	0 dig.	at 7. 37

Its *Duration* hence appears to have been one hour and 54 m. Its *greateſt Obſcurity* ſomewhat more than 7. digits. About the middle, between the Perpendicular and Weſtward Horizontal *Radius* of the Sun, viewing it through Mr *Boyle's* 60. foot-*Teleſcope*, there was perceived a little of the Limb of the Moon without the Diske of the Sun: which ſeemed to ſome of the Obſervers to come from ſome ſhining *Atmoſphere* about the Body either of the Sun or Moon.

They affirm to have obſerv'd the *Figure* of this *Eclipſe*, and meaſured the

Digits, by casting the *Figure* through a 5 foot *Telescope*, on an extended paper, fix't at a certain distance from the Eye-glasse, and having a round figure; all whose *Diameters* were divided, by 6 *Concentrick* Circles, into 12 *Digits*.

THe Observations made at *Madrid* by a Noble Member of the *Royal Society*, His Excellence the Earle of *Sandwich*, as they were sent to the Right Honourable, the Lord Vice-Count *Brounker*, are these;

The Eclipse *began* at *Madrid* about 5 of the Clock in the morning, at 5 h. 15'. the Suns *Altitude* was 6 deg. 55'.

The *Middle* of it was at 6 h. 2'. the Suns *Altitude*, 15. deg. 5'.

The *End* was exactly at 7 h. 5'; the Suns *Altitude*, 25. deg. 24'.

The *Duration*, 2 h. 4'.

37. Parts of the Suns diameter remained light.

63. Parts of the same were darkened.

THe Observations made at *Paris* by Monsieur *Payen*, assisted by several *Astronomers*, as they were printed in *French*, and addressed to Monsieur de *Montmor*, are these;

The *Eclipse* began there, at 5 h. 44'. 52". *mane*. It ended at 7 h. 43'. 6". So that its *whole Duration* was 1 h. 58'. 14". The *greatest Obscuration* they assign to have been 7. dig. 50. m. but they adde, that it seem'd to have been greater by 3 minuts; which M. *Payen* imputes to a particular motion of *Libration* of the Suns Globe, which entertain'd that Luminary in the same *Phasis* for the space of 8. *min.* and some *seconds*, as if it had been stopped in the midst of its Course; rather than to a tremulous Motion of the *Atmosphere*, as *Scheiner* would have it.

They intimate that they took the time of each *Phasis* from half *digit* to half *digit*, as well by a *Pendulum*, as by the *Altitudes* of the *Suns Center* above the *Horizon*, corrected by the *Verticall Paralaxes* and *Æstivall Refractions*, by which they judged, that though the Time by the *Pendulum* may be sufficient for *Mechanicall* Operations, yet 'tis not exact enough for establishing the *Grounds of true Astronomy*.

They further conceive that the apparent *Diameters* were almost equal; seeing that in the *Phasis* of 6. *Digits*, the *Circumference* of the *Moons disk* passed through the *Center* of that of the *Sun*, so as that two Lines drawn through the two *Horns* of the Sun, made with the *Common Semi-diameter* two *Equilateral Triangles*.

Next, they affirm, That there was so great a Variation in the *Parallaxes*, by reason as well of the Refractions of the Air, which environs the Earth, as of the Alteration of the Air, which encompasses the Moon, that the *Horns* of the Sun, there formed by the Shaddow of the Moon, appeared in all kinds of *Figures*; Sometimes inclined to the *Vertical*, sometimes *Perpendicular* to the *Horizon*, and at last *Parallel*; the *Convexe* part respecting the *Heaven*, and the *Concave*, the *Horizon*. By the crossing (*so they go on*) of the

Horns

Horns with the *Angles of Inclination*, it will be easie to those, that have exactly observed them, and that are skill'd in the higher *Astronomical* Calculations, to compute the *true Place* of the *Moon* in her *Orbite*, that so it may be compared with that of the *Tables*, and with that, which has been observ'd in other places, for the more precise determinating of the *Difference* of *Meridians* (that being the way, esteem'd by *Kepler* the most certain) and for making a good Judgment of the defect or exactness of the Celestial *Tables*.

Then they observe, That the *Beginning* and the *Middle* of this *Eclipse* hapned to be in the *North Eastern Hemisphere*, and the *End*, in the *South-Eastern*. The *first Contact* (as 'twere) of the two Disks was observ'd in the *Superior Limb* of the *Suns Disk* in respect to the *Vertical Line*, and in the *Inferior* in respect to the *Ecliptick*: But the *Middle*, and the *End* were seen in the *Superior Limb*, in respect both to the *Vertical* and the *Ecliptick*: And (what to this Author seems extraordinary) both the *Beginning* and the *End* of this *Eclipse* hapned to be in the *Oriental* part of the Suns Disk.

Lastly, they take notice, that by their Observations it appears, that there is but little exactness in all the *Astronomical Tables*, predicting the *Quantity*, *Beginning* and *Duration* of this Eclipse; Those of *Lansbergius* importing, That the Obscuration should be of 10. dig. 48'; those of *Riccioli*, of 9. dig. 1'; and those of *Kepler*, of 7. dig. 30'. 16'': Again, that the *Duration* should be of 2 h. 2'. Lastly, The *Beginning* did anticipate the *Riccioian Tables* by 5. *minuts*; the *End* by 23; and the *Middle*, almost by 11. In the mean time the Author notes, that the *Rudolphin Tables* come nearest to the Truth; and withal assures the *Reader* of the goodness of the *Instruments* employed in his *Observations*, and of the singular care, he, together with his skilful Assistants, took in making them.

Some Inquiries and Directions concerning Tides, *proposed by Dr.* Wallis, *for the proving or disproving of his lately publish't* Discourse *concerning them.*

The Inquisitive Dr. *Wallis*, having in his lately printed *Hypothesis* of Tides intimated, that he had reason to believe, that the *Annual Spring-tides* happen to be rather about the beginnings of *Febr.* and *Nov.* than the two *Æquinoxes*, doth in a late Letter to the *Publisher*, written from *Oxford* in *Aug.* last, desire, Sea, some understanding Persons at *London*, or *Greenwich*, but rather nearer the that or upon the Sea-shore, would make *particular* Observation of all the *Spring-Tides* (*New-Moon* and *Full-Moon*) between this and the End of *November*; and take account of the *Hour*, and of the *Perpendicular height*: that we may see, whether those in *September*, or those of *November* be highest: And it were not amiss, the Low waters were observed too. Which may be easily done by a mark made upon any standing Post in the Water, by any

Water-man, or other underſtanding Perſon, who dwells by the Water-ſide.

It would alſo deſerve (thinks he) to be inquired into, whether, when the Tides be higheſt, the Ebbs be ever loweſt, *& contra*; (which is generally affirmed, and almoſt put out of queſtion) or rather (which ſutes beſt with his *Hypotheſis*) whether, when the Tides are higheſt, both in the *Annual* and *Menſtrual* Periods, the Low waters be not alſo higheſt; and at Neap-Tides, the Ebbes alſo very low.

He adds, that he ſhould expect, that the Spring-Tides now coming, and thoſe at the beginning of *September*, ſhould not be ſo high, as thoſe at the *middle* of *September*; and then lower again at the *beginning* of *October*, and after that, higher at the *middle* of *October*, and higher yet about the *beginning* of *November* (at the uſual times of *Spring-tides* after the *New* and *Full*.)

Conſiderations and Enquiries concerning Tides, *by Sir* Robert Moray; *likewiſe for a further ſearch into Dr.* Wallis's *newly publiſh't* Hypotheſis.

In regard that the High and Low waters are obſerved to increaſe, and decreaſe regularly at ſeveral ſeaſons, according to the Moons age, ſo as, about the *New* and *Full Moon*, or within two or three daies after, in the Weſtern parts of *Europe*, the *Tides* are at the *higheſt*, and about the *Quarter-Moons*, at the *loweſt*, (the former call'd *Spring-tides*, the other *Neap-tides*;) and that according to the height and exceſſes of the *Tides*, the *Ebbes* in oppoſition are anſwerable to them, the heigheſt Tide having the loweſt Ebbe, and the loweſt Ebbe, the higheſt Tide; the Tides from the *Quarter* to the *higheſt Spring-tide* increaſing in a certain proportion; and from the *Spring-tide* to the *Quarter-tide* decreaſing in like proportion, as is ſuppoſed: And alſo the *Ebbes* riſing and falling conſtantly after the ſame manner: It is wiſhed, that it may be inquired, in what proportion theſe Increaſes and Decreaſes, Riſings and Fallings happen to be in regard of one another?

And 'tis ſuppoſed, upon ſome Obſervations, made in fit places, by the above-mentioned Gentleman, though, (as himſelf acknowledges) not thoroughly and exactly performed, that the Increaſe of the Tides is made in the *Proportion* of *Sines*; the firſt Increaſe exceeding the loweſt in a ſmall proportion; the next in a greater; the third greater than that; and ſo on to the mid-moſt, whereof the exceſs is greateſt, diminiſhing again from that, to the higheſt Spring-Tide; ſo as the proportions, before and after the *Middle*, do greatly anſwer one another, or ſeem to do ſo. And likewiſe, from the *higheſt Spring-tide*, to the *loweſt Neap-tide*, the *Decreaſes* ſeem to keep the like proportions; the *Ebbes* riſing and falling in like manner and in like proportions. All which is ſuppoſed to fall out, when no Wind or other Accident cauſes an alteration.

And

And whereas 'tis obſerved, that upon the main Sea-ſhore the Current of the Ebbings and Flowings is ſometimes ſwifter, and ſometimes ſlacker, than at others, ſo as in the beginning of the Floud the Tide moves faſter but in a ſmall degree, increaſing its ſwiftneſs conſtantly till towards the *Middle* of the Floud; and then decreaſing in velocity again from the *Middle* till to the top of the High-water; it is ſuppoſed, that in Equal ſpaces of Time, the Increaſe and Decreaſe of velocity, and conſequently the degrees of the Riſings and Fallings of the ſame, in Equal ſpaces of time, are performed according to the *Proportion* of *Sines*.

But 'tis withall conceived, that the ſaid *Proportion* cannot hold *exactly*, and *preciſely*, in regard of the *Inequalities*, that fall out in the *Periods* of the *Tides*, which are commonly obſerved and believed to follow certain *Poſitions* of the *Moon* in regard of the *Equinox*, which are known not to keep a *preciſe* and *conſtant* Courſe: ſo that, there not intervening equal portions of Time between one New-Moon and another, the Moons return to the ſame *Meridian*, cannot be alwaies perform'd in the ſame Time; and conſequently there muſt be a like Variation of the Tides in the Velocity, and in the Riſings and Fallings of the Tides, as to equal ſpaces of time. And the Tides from New-moon to New-moon being not alwaies the ſame in number, as ſometimes but 57, ſometimes 58, and ſometimes 59, (without any certain order of ſucceſſion) is another evidence of the difficulty of reducing this to any great exactneſs. Yet, becauſe 'tis worth while, to learn as much of it, as may be, the *Propoſer* and many others do deſire, That Obſervations be conſtantly made of all theſe Particulars for ſome Months, and, if it may be, years together. And becauſe ſuch Obſervations will be the more eaſily and exactly made, where the Tides riſe higheſt, it is preſumed, that a fit *Apparatus* being made for the purpoſe, they may be made about *Briſtol* or *Cheap-ſtow*, beſt of any places in *England*, becauſe the Tides are ſaid thereabout to riſe to ten or twelve fathoms; as upon the coaſt of *Britanny* in *France*, they do to thirteen and fourteen.

In order to which, this following *Apparatus* is propoſed to be made uſe of. In ſome convenient place upon a Wall, Rock, or Bridge, &c. let there be an *Obſervatory* ſtanding, as neer as may be to the brink of the Sea, or upon ſome wall; and if it cannot be well placed juſt where the Low water is, there may be a Channel cut from the Low water to the bottom of the Wall, Rock, &c. The Obſervatory is to be raiſed above the High-water 18. or 20. foot; and a Pump, of any reaſonable dimenſion, placed perpendicularly by the Wall, reaching above the High-water as high as conveniently may be. Upon the top of the Pump a Pulley is to be faſtned, for letting down into the Pump a piece of floating wood, which, as the water comes in, may riſe and fall with it. And becauſe the riſing and falling of the water amounts to 60. or 70. foot, the Counterpoiſe of the weight, that goes into the Pump, is to hang upon as many Pulleys, as may ſerve to make it riſe & fall within the ſpace, by which the height of the Pump exceeds the height of the Water. And becauſe by this

this means the Counterpoiſe will riſe and fall ſlower, and conſequently by leſs proportions, than the weight it ſelf, the firſt Pulley may have upon it a Wheele or two, to turn *Indexes* at any proportion required, ſo as to give the minute parts of the motion, and degrees of riſings and fallings. All which is to be obſerved by *Pendulum-Watches*, that have *Minutes* and *Seconds*, with *Cheeks*, according to Mr. *Hugens's* way.

And becauſe if the Hole, by which the water is let into the Pump, be as large as the Bore of the Pump it ſelf, the weight that is raiſed by the water, will riſe and fall with an Undulalation, according to the inequality of the Sea's Surface, 'twill therefore be fit, that the Hole, by which the water enters, be leſs than half as bigg as the Bore of the Pump; any inconvenience that may follow thereupon, as to the Periods and Stations of the Floud and Ebb, not being conſiderable.

And to the end, that it may appear the better, what are the *particular* Obſervations, deſired to be made, near *Briſtol* or *Cheap-ſtow* bridg, it was thought not amiſs, to ſet them down diſtinctly by themſelves.

1. The degrees of the Riſing and Falling of the water every quarter of an hour (or as often as conveniently may be) from the Periods of the Tides and Ebbs; to be obſerved night and day, for 2 or 3 months.

2. The degrees of the velocity of the Motion of the Water every quarter of an hour for ſome whole Tides together; to be obſerved by a ſecond *Pendul*-watch; and a logg faſtened to a line of ſome 50 fathoms, wound about a wheel.

3. The exact meaſures of the Heights of every utmoſt High-water and Low-water, from one Spring-tide to another, for ſome Months or rather Years.

4. The exact Heights of Spring-tides and Spring-Ebbs for ſome Years together.

5. The Poſition of the Wind at every obſervation of the Tides; and the times of its Changes; and the degrees of its Strength.

6. The State of the Weather, as to Rain, Hail, Miſt, Hazineſs, &c. and the times of its Changes.

7. At the times of obſervation of the Tides, the height of the *Thermometer*; the height of the *Baroſcope*; the height of the *Hygroſcope*; the Age of the Moon, and her *Azimuths*; and her place in all reſpects; And laſtly the *Sun*'s place; all theſe to *minutes*.

And it would be convenient, to keep *Journal Tables*, for all theſe Obſervations, each anſwering to its day of the Month.

For the *Apparatus* of all theſe obſervations, there will be particularly neceſſary.

A good *Pendulum*-watch.

A *Vane* ſhewing *Azimuths* to minute parts.

An *Inſtrument* to meaſure the ſtrength of the Winde.

A large and good *needle* ſhewing *Azimuths* to degrees.

Ther-

Thermometers, *Barometers*, *Hygroſcopes*.

Theſe Obſervations being thought very conſiderable as well as curious, 'tis hoped, that thoſe who have conveniency, will give encouragement and aſſiſtance for the making of them; and withall oblige the publick by imparting, what they ſhall have obſerved of this kind: The *Publiſher* intending, that when ever ſuch obſervations ſhall be communicated to him, he will give notice of it to the *publick*, and take care of the improvement thereof to the beſt uſe and advantage. A *Pattern* of the *Table*, propoſed to be made for obſerving the *Tides*, is intended to be publiſhed the next opportunity, God permitting.

An Account Of ſeveral Books lately publiſhed.

I. *Johannis Hevelii* DESCRIPTIO COMETÆ, *Anno Æræ Chriſtianæ* MDCLXV. *exorti; unà cum* MANTISSA *Prodromi Cometici, Obſervationes omnes prioris* COMETÆ MDCLIV, *ex iiſque genuinum motum accuratè deductum, cum Notis & Animadverſionibus, exhibens.*

This Book (as the Title it ſelf intimates) undertakes two things. *Firſt*, To give an Account of the *Second* of the two late Comets, which appeared, when the *other* was ſcarce exſtinct; Concerning which, the Author doth, from the Obſervations made by himſelf with a *Sextant* of 6 foot, and divided into *minutes* and *ſeconds*, aſſign *both* its true place (as well in reſpect of the *Ecliptick* as the *Æquator*) *and* its proper motion: Adding a fair Delineation of its Courſe, together with the genuine Repreſentations of its *Head* and *Train*, in each day of its apparition; and ſubjoyning a General Deſcription and Diſcourſe of ſome of the more notable *Phænomena* thereof. It was firſt ſeen at *Dantzick* by the Watchmen, the 5th of *April* ſt. n. 1665. and then obſerved by the *Author*, from *April* 6. about 1½ of the Clock in the morning, till *April* 20. at 3. in the morning. During which time, it went with a reaſonable velocity; making 46 deg. in its Orb, *according to the Order of the Signs*, moving from the *Breaſt* of *Pegaſus*, towards the *Head* of *Andromeda*, and the *Left Horn* of *Aries*; having, as 'tis preſumed, taken its riſe from above *Sagittary*, and run through the *Breaſt* of *Antinous*, under *Aquila*, and the *Dolphin*, to the ſaid *Pegaſus*; and ſo on, as is already expreſſed.

The *Head* of it is in the Book deſcribed of a Colour like that of *Jupiter*, all along much brighter than that of the former Comet, though of a ſomewhat leſs magnitude; having in its middle onely *one* round, but very bright and big *Kernel* or Speck, reſplendent like Gold, and encompaſſed with another more dilute and ſeemingly uniform matter: its *Tail* being at firſt, about 17 deg. and afterwards 20. and ſometimes 25 deg. long, and divaricated towards the End.

Next, it is obſerved, that though this Star did afterwards ſlacken its pace, yet it retained the vividneſs of its Colour, both of the *Head* and *Train*; the *Head* eſpecially, keeping at the time as well of the laſt obſervations, as of the

firſt

firſt, the brightneſs of its ſingle *kernel*, though the environing more dilute matter were then almoſt all loſt; it being, according to the Author, more and more attenuated, and grown narrow, the nearer the Star approached to the Sun.

Thirdly, 'tis noted, That this *Comet* did very much digreſs from the *Hypotheſis*, delivered by *M. Auzout*, in regard that, whereas according to that *Hypotheſis*, this Star ſhould not arrive to the *Ecliptick* till after the ſpace of 3 months, it arrived there the 28 of *April*. And then, that its firſt Conjunction with the Sun hapned between the 19 and 20 of *April*, and the ſecond, the laſt of *April*, not (as *M. Auzout*, would have it) the 15 of *May*. So that he concludes, that this Comet never came down to the *Pleiads* and the *Eye of Taurus*, as the Hypotheſis of *M. Auzout* requires, but that from *April* 20. it did immediately take its courſe towards the Ecliptick, deflecting every day more and more from the *Section* of a *Great Circle*, to the *Lucida* of *Aries*, arriving at the *Ecliptick* the laſt of *April*, about the 8th or 10th deg. of *Taurus*; not in *July* about the 8th of *Gemini*, and the *Eye of Taurus*.

Fourthly, He intimates, that if this Comet had appeared ſome few weeks ſooner, it would have confronted the former Comet, being yet in its vigour and of a conſpicuous bigneſs, in the ſame place, where that was, viz. the *Head of Aries*.

Fifthly, He obſerves, that this Star in progreſs of time became *Retrograde*, whence it came to paſs, that in the Months of *June* and *July* it did not appear again before the Riſing of the Sun, though the Sun left it far behind: whereas, if it had proceeded toward the *Eye of Taurus*, it would have appeared again in the morning.

Sixthly, He maintains, that this Comet was not the ſame with the former; which he thinks may be demonſtrated, onely by a due Delineation of both their Courſe upon the *Globe*; where he ſaith it to be evident, that the former could never come to the *Head* of *Pegaſus*, as moving already in *February* in a ſtreight Courſe about the *Head* of *Aries*: Beſides, that the *former* went in the very beginning in a *Retrograde* motion; but *this* perpetually in a direct one: *that*, about the end, very ſlow, its Head leſsning and growing dark; *this* ſwift enough, with its head conſpicuous and bright. To which he adds, that the whole Courſe of the former was made under a quite different *Angle* of the *Orbite* and *Ecliptick*, and a different Motion of the *Nodes* from the latter: As alſo that their *Faces* differed very much from one another; the *firſt* exhibiting all along a matter, which as to its denſity and rarity, altered from day to day exceedingly, whereas the *ſecond* retained (to the Authors admiration, who affirms, never to have obſerved the like) all the time he ſaw it, one and the ſame round, denſe and bright Speck or Kernel.

All which he concludes 1, With an Intimation of his ſenſe concerning two other Comets, pretended to have been lately ſeen, *One* at *Rome*, about the

Girdle

Girdle of Andromeda, in the Months of *February* and *March*, 1664. the other in *Germany* in *Capricorne*, about *Saturne* in the head of *Sagittary*, during the Months of *September* and *October*, 1665. 2ly. With an Advertiſement of what he has done in that important Work for the Advancement of *Aſtronomy*, the due *Reſtitution of the Fixt Stars*, *vid.* That he has almoſt finiſh't it, himſelf alone, without truſting to any other mans labour, that was not directed by him.

The *Second* Part of this Book (the *Mantiſſa* to the *Prodromus Cometicus*) endeavours to juſtifie the Authors Obſervations touching the former Comet, excepted againſt by M. *Auzout*, in ſeveral particulars; as 1. That it had not paſs'd to the *Firſt*, but *Second* Star in *Aries*, and had mov'd in quite another Line, than He had deſcribed. 2. That its *proper motion* about the end of *January* and the beginning of *February*, 1665. had not been rightly aſſigned. 3. That the *Bigneſſe* of its *Diameter* had not been truly delivered; Nor 4. The *Faces* of its *Head* in due manner repreſented.

To all which the Author endeavors to anſwer: 1. By delivering all his Obſervations of that Comet, thereby to ſhew, what care and diligence he had uſed, *particularly* to make out, how great its *Diurnal motion* had been, in what proportion, and how far, it decreaſed, and where and in what degree it increaſed again: Which being, as he conceives, duly and exactly deduced, and demonſtrated, he eſteems it afterwards to be eaſie for every one, verſed in theſe matters, certainly to collect and to judge, what way the Comet, after it became inviſible to the naked Eye, and could be no longer obſerved with *Sextants* and *Quadrants*, had taken, and what Line it had deſcribed. 2, By ſubjecting all thoſe Obſervations, with great diligence and labour, to a rigid *Calculus*, thereby to obtain, for every day, the *Longitudes*, *Latitudes*, *Right Aſcenſions*, *Declinations*, *Proper motion*, *Angle* of the *Ecliptick* and the *Æquator*, and the *Nodes* of that Comet; for the conſtruction of an *Ephemerides* of its whole Motion. From all which he pretends to prove, that he has not erred in his Obſervation of *February* 18. nor been prepoſſeſt by any *Hypotheſis*, nor deluded by any *Fixt Star*, as M. *Auxout* thinketh; but that near the *Firſt Star* of *Aries* there *then* appear'd a *Phænomenon*, moſt like to that Comet, that was ſeen ſome dayes before, if compared with the Obſervations made thereof *Febr.* 12, 13, 14. Though he will not hitherto poſitively determine, whether that *Phænomenon*, which appear'd to him *February* 18. was

indeed that very Comet, which he ſaw with his naked Eye, and obſerved with his Geometrical Inſtruments, the ſaid 12, 13, and 14. dayes of *February*; or whether it was another, and whether he had loſt that Comet, which moved towards the *Second Star* in *Aries*: but leaves it to the Learned World, and particularly to the *Royal Society*, after they ſhall have well examined and conſidered all his Obſervations, and the *Calculus* raiſed therefrom, to judge of this, and the other particulars in controverſie.

II. *Iſaacus Voſſius de* N I L I *et* A L I O R U M F L U M I N U M O R I G I N E. It was *Numb.* 14. of theſe *Tranſactions*, that gave an account of the *Cauſe* of the *Inundation of the Nile*, as it was rendred by Monſieur *de la Chambre*: *This* is to give you another, not only of the *Inundation*, but alſo of the *Origine* of that, and of *other Rivers*, as it is delivered by Monſieur *Iſaac Voſſius*, who undertakes in this Book to ſhew;

1. That thoſe *Subterraneous Channels*, through which ſeveral *Philoſophers* teach, that the Sea diſcharges it ſelf into the Rivers, are not only imaginary, but uſeleſs, in regard 'tis impoſsible for the water to riſe from the Subterraneous places up to the Mountains, where commonly the Sources of Rivers are.

2. He explicates, why, if a Pipe be put into a Baſon full of Water, the water is ſeen more raiſed in the Pipe, than in the Baſon, and riſes higher according as the Pipe is narrower; On the contrary, if the ſame Pipe be put into a Baſon full of Quickſilver, the Quickſilver ſtayes lower in the Pipe, than in the Baſon. The reaſon, which he renders hereof, is, That as the Water ſticks eaſily to all it touches, it is ſuſtain'd by the ſides of the narrow Pipe wherein it is included: And indeed, if the Pipe be quite drawn out of the Water, the Water doth not all fall out, but ſo much of it remains, as the ſides of the Pipe could ſuſtaine: Whence it is, that the Water which is kept up by the Walls of the Tube, weighing no longer upon that which is in the Baſon, is thruſt upwards, and keeps it ſelf raiſed above its Levell; but the Quickſilver not adhering ſo eaſily, as Water, to Bodies it touches, is not ſuſtained by the ſides of the Tube, and ſo mounts not above its Levell, but rather deſcends below it, becauſe the Pipe, which is ſtreight, hinders the endeavor that is in the *Mercury* to riſe to its Level. He adds, that this Obſervation makes nothing for the Explication of the *Origine of Rivers*; becauſe, though it be true, that the Water by

by this means riſes above its Levell, yet it does never run out at the top of the Pipe. Having ſaid this, he anſwers to the other Arguments, commonly alledged to maintain this Opinion.

3. He pretends, that all Rivers proceed from a *Colluvies* or *Rendevous* of Rain-waters, and that, as the Water, that falls upon *Hills*, gathers more eaſily together, than that which falls in *Plaines*, therefore it is, that Rivers ordinarily take their Source from *Hills*. Thence alſo comes it (ſaies he) that there are more *Rivers*, than *Torrents*, in the *Temperate Zones*; and, on the contrary, more *Torrents*, than *Rivers*, in the *Torrid Zone*: For, as in hot Climats the Mountains are far higher, the Water, that deſcends from them with impetuoſity, runs away in a little while, and formes ſuch Collections of Water, as ſoon dry up; but in cold Climats, the Waters do not run away but ſlowly, and are renew'd and recruited by Rain, before they are quite dryed up; becauſe the Hills are there lower, and ſo the Bed of Rivers hath leſſe declivity.

Having thus diſcourſed of *Rivers* in *General*, he treats of the *Nile* in *particular*; and there

1. Obſerves, That the Order of the Seaſons of the Year is quite inverted under the *Torrid Zone*. For, whereas it ſhould be then Summer, when the Sun is near; and Winter, when the Sun is farther off: Under the *Torrid Zone* 'tis never leſſe hot, than when the Sun is neareſt, nor more hot, than when the Sun is fartheſt off: So that to the people that live between the *Æquinoctial* and the *Tropicks*, Summer begins about *Chriſtmaſs*, and their Winter, about St. *Johns* day. The reaſon whereof is, (*ſaith he*) that when the Sun is directly over their Heads, it raiſes abundance of vapors, and draws them ſo high, that they are preſently converted into Water by the coldneſſe of the Air; whence it comes to paſſe, that then it rains continually, which does refreſh the Air; but when the Sun is farther off, there falls no more rain, and ſo the Heat becomes inſupportable.

2. He proves by many recent Relations, that the *Sources* of the *Nile* are on this ſide of the *Æquinoctial* in *Æthiopia*, of which he gives a very accurate *Mappe*, correcting many faults which *Geographers* are wont to commit in the Deſcription of the Kingdom of the *Abyſſins*, which they believe to be much greater than indeed it is.

3. This ſuppoſed, he eaſily gives an account, why the *Nile* yearly overflows about the end of *June*: For, as at that time there falls much rain in *Æthiopia*, it muſt needs be, that the *Nile*, whoſe ſource is in that Country, ſhould then overflow, when thoſe rains begin, and ſubſide, when they ceaſe.

There are beſides, in this Book, two other *Tracts*. In the *firſt*, M. *Voſſius* endeavours to maintain the Doctrine, he had deliver'd in his Book *De Lumine*, and to ſhew, that the *Soul* of Animals is nothing but *Fire*, that there are no inviſible Atoms; nor ſo much as any Pores, even in the Skin of man. Here he treats alſo of *Refractions*, and alledges the Examples of ſeveral perſons, who have then ſeen the Sun by the means of Refraction, when really He was under the *Horizon*.

In the *ſecond*, He diſcourſes of ſome points of the *Mechanicks*; and relates, among other things, that the *Arrows* and *battering Rams* (*Aries*) of the Antients did as much execution, as our *Muskets* and *Canons*; and then, that the Vehemence of the percuſſion depends as much upon the Length of the percutient Body, as upon the velocity of the Motion. He adds, that the Length of a Canon ought not to exceed 13 foot, and that a greater length is not onely uſeleſs, but hinders alſo the effect of the Gun, not becauſe the Bullet is thrown out of the Gun, before all the powder is fired (as ſome believe;) but becauſe the Bullet is then beaten back into the Gun by the Air, re-entring into it with impetuoſity, when the flame is extinct.

III. *LE DISCERNEMENT DU CORPS ET DE L'AME*, par M. *de Cordemoy*.

This *French* Treatiſe (but very lately come to the *Publiſher's* hands) examines the different Operations of the Soul and Body, and the Secret of their Union, pretending to diſcover to every one, what he is, and what is tranſacting within him. It conſiſts of ſix Diſcourſes.

1. In the *firſt*, the Author examines the Notions, we have in *general* of *Bodies* and *Matter*; of *Quantity*, of *Qualities*; of *Place*; of *Reſt*; of *Motion*; of *Vacuity*; of *Forms*: to ſhew what is to be underſtood by theſe Terms, which cauſe all the perplexity that is in the ordinary *Phyſicks*. He begins with taking notice, that hitherto *Philoſophers* have had no *diſtinct* notions of *Bodies* and *Matter*; from the want whereof he conceives, that almoſt all the Errors in Common *Phyſiology* have ſprung.

ſprung: To rectify which, he defines *Bodies* to be * *Extended Subſtances*, and *Matter* an *Aggregate of Bodies*. Whence he inferrs, that *Bodies* are Indiviſible and *Matter* diviſible; a *Body* being nothing but *one* and the *ſame* ſubſtance, whoſe different extremities are inſeparable, becauſe they are the extremities of one and the ſame Extenſion, and, in a word, of one and the ſame Subſtance: but *Matter* being nothing but an Aſſociation or Collection of Bodies, 'tis evident, (*ſaith he*) it muſt be diviſible. This doctrine he ſo much inſiſts upon, that he conceives, Nature cannot ſubſiſt, if a Body in the ſence he takes it, be diviſible; and that *Motion* and *Reſt* cannot be explicated without it. As for *Quantity*, he makes that to be nothing but More or Leſs Bodies; not allowing, that each Body ſhould be a Quantity, though it be a part of Quantity; no more than an *Unite* is a Number, though it make part of a Number: ſo that *Quantity* and *Extenſion* are two diſtinct things with him, the *firſt* belonging properly to *Matter*, the laſt to a *Body*. Touching *Vacuity*, he conceives, that the Bodies, which compoſe a maſs, are not every where ſo near one another, as not to leave ſome interval in ſeveral places. Neither does he think it neceſſary, that thoſe intervals ſhould be fill'd up; nor unconceivable, that there ſhould be no Body between two Bodies, which touch not one another. And when 'tis ſaid, that thoſe intervals cannot be conceived without Extenſion, and that conſequently there are Bodies that repleniſh them, he frankly pronounces that not to be true; and affirms, that though it may be ſaid, that between two Bodies, which touch not one another, other Bodies may be placed of ſo or ſo many feet, &c: yet ought it not to be inferred, that therefore they *are* there, but onely, that they are thus placed, that there *may* be put between them ſo many Bodies, as joyned together would compoſe an Extenſion of ſo many feet. So that one conceives onely, that Bodies *may* be placed there, but not that they *are* there: and as we can have an *Idea* of many Bodies, though none of them be in being; ſo we can conceive, that ſome Bodies *may* be put between others, where really there are none. And when 'tis alledged; that if all the Bodies, that fill a veſſel full, were deſtroyed, the ſides of the veſſel would be cloſed together; He profeſſes, he underſtands not that ratiocination, nor can conceive, what one Body does to the ſubſiſtence of another, more than to ſuſtain themſelves mutually, when they are thruſt by the neighbouring ones: and therefore ſees not, why the ſides of the veſſel ſhould cloſe, if nothing did thruſt them together; but underſtands clearly, that two Bodies may well ſubſiſt ſo far from one another, that one might place a great many Bodies between them, or none at all, and yet they neither approach to, nor recoil from one another.

* *It ſounds hard, To ſay, An* extended *ſubſtance is* indiviſible.

2. In the *Second*, he examines the *Changes*, which he knows in Matter, and makes it his buſineſs to explicate all thoſe that reſpect *Quantity*, *Qualities* and *Forms*, by *Local Motion*, eſteeming their needs no other.

3. In the *third*, he explains the Motion of *Artificial* Engins, and that of *Natural* ones, by one and the ſame Cauſe; endeavouring among other things to ſhew, that the Body of an Animal is moved after the ſame manner with a Watch. That cauſe of motion he makes the *Materia Subtilis*; and the finer or ſubtiler that is, the better and fitter he conceives it to be to preſerve Motion.

4. In the *Fourth*, he teaches, that though Experience ſeems to evince, that the Soul moves the Body, and that one Body moves an other; yet there is nothing, but God, that can produce any motion in the World, and all other Agents, which we believe to be the *Cauſe* of this or that Motion, are no more but the *Occaſion* thereof. In doing this, he advances certain *Axioms*, and Concluſions, which are in ſhort,

a. The *Axioms*: That no ſubſtance has that of it ſelf, which it can looſe, without ceaſing to be, what it is: That every body may looſe of its motion, till it have no more left, without ceaſing to be a Body: That we cannot conceive but two ſorts of ſubſtances, *vid.* a *Spirit* (or *That which thinketh*) and a *Body*, wherefore they muſt be conſidered as the Cauſes of all, that happens, and what cannot proceed from the one, muſt neceſſarily be adſcribed to the other: That to *Move*, or to cauſe motion, is an Action: That an Action cannot be continued but by the Agent, who began it.

b. The *Concluſions*; That no *Body* hath Motion of it ſelf: That the Firſt Mover of Bodies is not a Body: That it cannot be but a *Spirit*, that is the Firſt Mover: That it cannot be but the ſame Spirit, who has begun to move Bodies, that continues to move.

In the *Fifth*, He treats of the Union of the Body and Soul, and the manner, how they act one upon the other; and eſteems it not more difficult to conceive the Action of Spirits upon Bodies, and of Bodies upon Spirits, than to conceive the Action of Bodies upon Bodies: the cauſe of the great difficulty in underſtanding the two former, ariſing (according to him) from thence, that we will conceive the one by the other, not conſidering, that every thing acting according to its own nature, we ſhall never know the action of one Agent, if we will examine it by the notions we have of another, that is of a quite differing nature. Here he notes, that the Action of Bodies upon Bodies is not more

more known to us; than that of Spirits upon Bodies, or of Bodies upon Spirits; and yet moſt men admire nothing but *this*, believing to know the *other*: whereas he Judges, that all things being well examin'd, the Action of Bodies upon Bodies is no more conceivable, than that of Spirits upon Bodies. Mean while the opinion of the Authour touching this ſubject, is, That the union of Soul and Body conſiſts onely in this, that certain motions of the Body are followed by certain *Cogitations* of the Soul, and, on the contrary, that certain Thoughts of the Soul are follow'd by certain *Motions* of the Body. And, having ſuppoſed, that Bodies are ſaid to act upon one another, when they cauſe ſome change ſuitable to Extenſion; and Spirits to act upon one another, when they cauſe ſome change ſuitable to a Thought; he infers, that when a Body acts upon a Spirit, that cannot be by cauſing any change of motion, of figure, or parts, as having none of all theſe; nor when a Spirit acts upon a Body, that cannot be by producing any change of Thought, as having none: But, when this Body, or its motion, or figure, or other thing, depending upon its nature, can be perceived by a Spirit, ſo as, upon that occaſion, this Spirit has thoughts, it had not before, it may be ſaid, that the Body has acted upon this Spirit, for as much as it has cauſed all the change in it, whereof it was capable according to its nature.

In the *Sixth*, After he hath ſhew'd, what is to be underſtood by what we call *Soul*, and by what we call *Body*, he labours to make it out, that we are much more aſſured of the Exiſtence of the Soul, than of that of the Body, which he conceives he can prove from hence, that we cannot doubt, that we think, becauſe even doubting is thinking; but one may doubt, whether one has a body, for ſeveral reaſons, which he alledges, and thinks ſo cogent, that he concludes, it is not evident to him by the light of reaſon, that he has a Body. But ſuppoſing, there be Bodies, he examines, what are the Operations, that belong to the Soul, and what thoſe, that belong to the Body; and laſtly, what thoſe, that reſult from the Union of both: And then explains, how all thoſe operations are perform'd, and particularly, *Senſation*; where he ſhews, that the Nerves, holding at one end to the Brain, whereof they are but Allongations, and being at the other end extended to the extremities of the Body; when an Object comes to touch thoſe exterior ends of the Nerves, the interior ones in the Brain are preſently ſhaken, and cauſe different ſenſations according to the diverſitie of Nerves, and the differing manner, in which they are ſhaken. And to ſhew, that 'tis this ſhaking, that cauſes Senſation, he notes, that if any thing ſhakes the interior parts of the Nerves, though the object be abſent, the Soul has preſently the ſame ſenſations

ſations; as it would have, if it were preſent. As, if one ſhould knock on's head forcibly againſt a wall, the ſhaking, which the blow gives to the Brain, moving the interior extremities of the Nerve, which cauſes the ſenſation of Light, the Soul has the ſame ſenſation, which it would have, if it ſaw a thouſand Candles: On the contrary, if the interior extremities of the nerves are not ſhaken, though the object be preſent, it cauſes no ſenſation; whence it comes, that if a ſtrong Ligature be made upon the middle of the Arm, and the hand be then prickt, no pain is felt, becauſe the ſhaking of the nerves that are pricked, being ſtopped by the Ligature, cannot reach to the extremities of the Nerves, that are within the Brain.

Advertiſement.

The following *Errata*, left by the *Preſs* in *Num.* 16, the *Reader* is deſired thus to correct.

PAge 169. lin. 27. read, *motion of B. above the Center; G. is alſo*, with a *Semi-colon* after the word *Center*. p. 274. l. 13, r. *it to do to the*. p. 277. l. 24. r. *natural days*. p. 281. l. 16. r. *of his*. ib. l. 27. r. *a notion*. p. 293. l. 4. r *enough without*. ib. l. 43. r. *to the Sine of*. p. 294. l. 1. r. *to the Sine of*.

LONDON,
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PHILOSOPHICAL TRANSACTIONS.

Munday October. 22. 1666.

The Contents.

Patterns *of the* Tables *propoſed to be made for* Obſerving of Tides; *promiſed in the next foregoing* Tranſactions. *Other* Inquiries *touching the Sea. Some Conſiderations touching the* Parenchymous *parts of the Body. Obſervables concerning* Petrification. *A Relation from* Paris, *of a kind of* Worms, *that eat out Stones. Some promiſcuous Obſervations made in* Somerſetſhire. *A Problem for finding the Year of the* Julian Period, *by a new and very eaſie Method. An Account of ſome Books, not long ſince publiſh't: which are,* 1. Tentamina Phyſico-Theologica de Deo, *authore* Samuele Parkero. 2. Honorati Fabri Tractatus duo; Prior, de Plantis et de Generatione Animalium; Poſterior, de Homine. 3. Relation du Voyage de l' Eveſque de Beryte, par la Turquie, la Perſe, les Indes, *&c. par Monſieur de* Bourges.

Patterns

Of the Tables *propoſed to be made for* Obſerving of Tides, *promiſed in the next foregoing* Tranſactions; *by Sir* Rob. Moray.

IN performance of what was promiſed in the laſt of theſe *Papers* for Obſerving the *Tides*, here are ſubjoyned *Patterns* of the *Tables* there mentioned: *One*, for making the *preciſe Time* of the High waters and Low-waters during one Month; that is, between *New* and *New* Moon, or *Full* and *Full* Moon. The *other*, for marking the *Degrees* of the Riſings and Fallings of the Water in *Equal* ſpaces of Time, and the *Velocity* of its motion at *ſeveral* heighes: The *Degrees* of *Heat* and *Cold*, &c.

The *Times*, aſsigned in the *firſt*, to the High-waters and Loweſt Ebbs, are taken out of Mr. *Wing*'s Almanack, for this preſent year 1666. as he calculates them for the Month of *September* for *London Bridge*. Only, whereas he takes notice but of *one* High-water for every day, *Here* are ſet

down the Times of the other, and the two Ebbs intervening, by ſubdividing the *Differences*, he aſsignes between two Tides, equally amongſt them. In all which, though there may be Errors, that is not to be conſidered, ſeeing the Diſſein is to Correct and State the *Times* of the *Tides exactly* by *Experiments*, after this method. Mr. *Wing* ſtates the High waters to fall out at *London-Bridge* conſtantly, when the Moon is 46. deg. 30. min. to the *Weſt-ward* of the *Meridian*. For the Times, he marks for them, are made up by adding every day 3. hours, 6 minutes, to thoſe in his *Table* for knowing the Time of the Moons coming to the South.

The *Firſt Table* conſiſts of *two* Parts, and each part of *four Columns*. The *firſt* part marks the Tides and Ebbs from the day of the *New*-Moon to its *Full*: The *other*, from the *Full* to the next *New*. The *firſt Column* in both parts hath the day of the Month and Week; *M.* ſtanding every where for *Morning*, and *A.* for *Afternoon*. The *third* Column hath the *Character* of the day of the Week prefixt to the Hour and Minute of the High-water, and anſwering to the day of the Month. The *laſt* Column hath the ſame for the time of Low-water, varying the *Character* of the day, as often as the Low-water falls out more early than the High-water. In this *Example* between the ſaid *New* Moons there falls out in all juſt 57. periods of the Tide or Flowing water, and 58. of the Ebb or Low-water; which numbers vary according to the Intervals of the Moons changes; but with what conſtancy and exactneſs, is to be inquired after: Which whoſoever undertakes to do, may keep ſuch a *Table*, as is here propoſed, in a Book by it ſelf.

The *other* Table doth in 9. *Columns* comprehend the particular Obſervations of the *Degrees* of the Riſing and falling of the Tides, and the other things ſpecified at the Tops of them: The *firſt* Column marking the Hour and Minut common to all the ſeveral Obſervations. Each hour is divided in 3. equal Parts, that number of Obſervations being only pitch't upon by way of *Example*: The numbers may elſe be varied at pleaſure, when other more frequent Obſervations are thought fit to be made, or when they prove too frequent and laborious; though the moſt frequent are moſt deſirable, till competent information of all particulars be attained.

The *Riſing* of the Tide from Low-water to the higheſt pitcht of the Full Sea, is here ſuppoſed to be 60. foot: And the Degrees of its riſing every 20. Minuts, to be in the *Proportion* of *Signes*, The whole time of Flowing ſuppoſed to be 6. hours. But this *Example* will ſerve for marking the *Spaces* of the Increaſing or Riſing, as well as of the falling of the water, in order to the Inveſtigation of their *Proportions* to one another, when the *Duration* of the Tide exceeds 6, hours by any number of *minuts*, as well as for juſt 6. hours; ſeeing they may be eaſily collected from any Number of Obſervations; their preciſe Time and that of the Duration of the waters Riſing and Falling (that is, the juſt interval between the High-water and Low-water) being known: This Calculation by *Signes* being only ſet down as a *Conjecture*, flowing from Obſervations of the Motion of the water in its Riſing and Falling, which

which ſeems to obſerve this or ſome ſuch like Proportion; which is ſuppoſed ſtill to hold in *all* Tides, be the *Duration* what it will; the Increaſe ſtill continuing proportionably till the very midle of the Hight and Duration, and Decreaſing afterwards in the ſame manner: Which whether it be ſo indeed or not, is that, which is deſired to be known.

There is the like Proportion here ſuppoſed to be in the *different degrees* of the *Velocity* of the Current of the Water after *Equal* ſpaces of Times, as in its Riſing and Falling: And ſo it is markt in the *Third* Column. But becauſe the *true Velocity* of the Current of the Water, raiſed above the Level $\frac{216}{1000}$ of a foot, is unknown, it is by way of Suppoſition ſet at Ten feet in one Minute of an Hour, which being once ſtated, the reſt diſtant from each other by the ſpace of 20. Minutes of an Hour, are ſet down according to the ſame *Proportion* of *Signs* before ſuggeſted. It being ſuppoſed, that of the *Velocity* of the Current of the Tide, after it hath flowed 20 minuts of an hour, be ſuch, as a Log of Wood placed in the Water will move 10 foot in the ſpace of one minute of time, at the middle of the Tide it will in the like ſpace of Time move 114 f. $\frac{216}{1000}$, and ſo proportionably at other times: Which, howſoever theſe Proportions ſhall be found by Experiments to fall out, may be not unworthy of the pains and charges requiſite to acquire the knowledge of it. For, beſides the ſatisfaction it may afford upon other accounts, it may poſsibly be of no ſmall uſe to thoſe, who need an exact reckoning of their Ships running, when the Velocity of the Current of the Tide may be neceſſary to be known; leſt through the defect of the knowledge of that, eſpecially when it is reckoned leſs than indeed it is, the Ship be thrown in the night upon Shores, Rocks or Sands, when they reckon themſelves to be far from them.

The Numbers in the 4, 5, 6, 7, and 8. *Columns* are ſet down at random, only for *Examples* ſake; there being no difficulty in the apprehenſion of it, and imitating of it in ſetting down the true Hights and Variations of the *Thermometer*, *Baroſcope*, &c. The Uſe whereof is ſo vulgarly known, that there needs no further Direction concerning them. But if any perſon who would make theſe Experiments, do not know the fabrick or uſe of any of the Inſtruments requiſite for ſome of theſe Obſervations, nor where to have them, he may addreſs himſelf to Mr. *Shortgrave*, one of the *Operators* of the *Royal Society*, lodged in *Greſham Colledge*, from whom he will receive full ſatisfaction about theſe things.

But the labour employed in the Obſervations of the Heat, Cold, &c. required to be taken notice of in order to the Ends propoſed in the former *Tract*, and others that may be of no leſs delight than advantage, will be much retrenched, when Dr. *Chriſtopher Wren* puts in practice, what he ſome years ago propoſed to the *Royal Society* concerning an *Engine* with a *Clock-work*, which may perform theſe Obſervations in the laſt enumerate *Columns*, without being toucht or lookt after but once or twice a day.

The Tables themſelves follow,

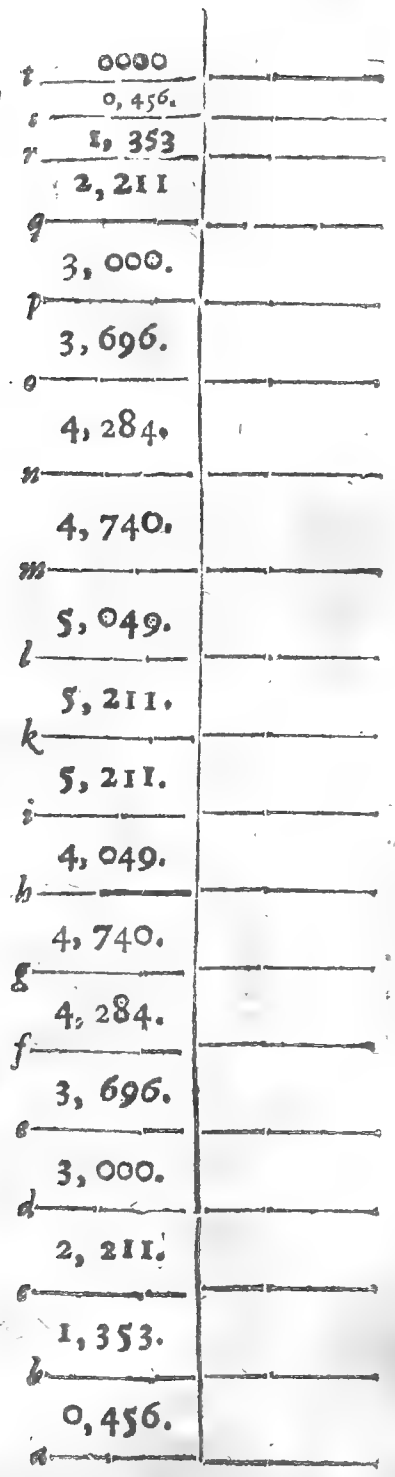
Age of
the)
ho.mi.

New
8.38'.

Qu.
1.0 A.
)

Sept.	Age of the ☽ ho. mi.	Time of High-water. Day. Hour. min.		Time of Low-water. Day. Hour. Min.		1666. Sept 18.	Age of the ☽ ho. mi.	Time of High-water. Day. Hour. Min.	Time of Low-water. Day. Hour. Min.	1666 Sept. 3. Hour. M.	Rising, and fall of Tide. Foot 1000	Velocity of the Current. Foot 1000	Thermometre inch 10	Baroscope Inch 10	Hygroscope Inch 10	Azimuth deg.	Force of the Wind deg.	Weather.
1	*New* 8.38'. ●	☽ 2 57	Morn.	☽ 9 8	Morn.	♂ 18	*Full* 11 10	♂ 2 50½	M. ♂ 9 4¾	M.	0 000	00 000						
		3 19	Aftern	9 30	Aftern.		○	3 18	A. 9 31¼	A	XII. 00	0 456	00 000	6 7	28 1	3 4	S. to W.	50 3	*Rain great*
2		♂ 3 41	M.	♂ 9 51½	M.	☿ 19		☿ 3 45	M. ☾ 9 58½	M.	20	1 353	10 000	6 7	28 1	3 4	S. to W.	57 3	*Rain great*
		4 2	A.	10 12½	A.			4 12	A. 10 25½	A	40	2 211	36 250	6 8	28 1	3 4	S. to W.	60 3	*Rain small*
3		☿ 4 23	M.	☿ 10 33¼	M.	♃ 20		♃ 4 39	M. ♃ 10 52½	M.	I. 00	3 000	48 587	6 8	28 1	3 3	S. W.	45 4	*Rain small*
		4 43½	A.	10 54¾	A.			5 6	A. 11 20	A.	20	3 696	66 658	6 8	28 1	3 2	S. W.	30 4	*Rain very small*
4		♃ 5 4	M.	♃ 12 14½	M.	♀ 21		♀ 5 34	M. ♀ 11 48	M.	40	4 284	81 053	6 9	28 2	3 1	S. W.	36 4	*Fair but cloudy*
		5 25	A.	11 35½	A.			6 2	A. 0 16	A	II. 00	4 740	93 289	6 9	28 2	3 0	S. W.	39 5	*Fair and warm*
5		♀ 5 46	M.	♀ 11 56½	M.	♄ 22		♄ 6 30	M ♄ 0 44	A	20	5 049	103 289	6 9	28 2	2 7	S. W.	42 5	*Warm and cloudy*
		6 7	A.	♄ 0 17½	M.			6 58	A. ☉ 1 12½	M.	40	5 211	110 724	6 8	28 2	2 3	S. W.	19 6	*Sunshine*
6		♄ 6 28	M.	0 39½	A.	☉ 23		☉ 7 27	M. 1 41½	A.	III. 00	5 211	114 276	6 8	28 2	2 0	S. W.	60 5	*Sunshine and clear*
		6 51	A.	☉ 1 2½	M.			7 36	A. ☽ 2 10¼	M	20	5 049	110 724	6 7	28 3	2 1	S. W.	73 5	*Sun clouded*
7		☉ 7 14	M.	1 25½	A.	☽ 24		☽ 8 24½	M. 2 38¾	A.	40	4 740	103 289	6 7	28 3	2 0	. W.	90 6	*Cloudy (the Horiz*
		7 37	A.	☽ 1 48¼	M.			8 53	A. ♂ 3 6¾	M.	III. 00	4 284	93 289	6 6	28 3	2 1	S. W.	90 6	*Hazy about*
8		☽ 8 0	M.	2 13	A.	♂ 25		♂ 9 20½	M. 3 34¼	A.	20	3 696	81 053	6 6	28 4	2 3	N. W.	87 6	*Misty*
	1 Qu.	8 26	A.	♂ 2 39	M.			9 48	A. ☿ 1 1¾	M.	40	3 000	66 658	6 5	28 4	2 3	N. W.	70 7	*Misty*
9	10.0 A.	♂ 8 52	M.	3 5	A.	☿ 26	last Q.	☿ 10 15½	M. 4 29¼	A.	00	2 211	48 487	6 4	28 4	2 3	N. W.	59 7	*Clearing up*
	☽	9 18	A.	☿ 3 31	M.		3 11'.	10 43	A. ♃ 4 56½	M.	V. 20	1 353	36 250	6 2	28 5	2 3	N. W.	50 6	*Clear*
10		☿ 9 44	M.	3 57¾	A.	♃ 27	☽	♃ 11 10	M. 5 2½	A.	40	0 456	10 000	6 1	28 5	2 1	N. W.	60 5	*Sunshine*
		10 11½	A.	♃ 4 25¼	M.			11 37	A. ♀ 5 48	M.	VI. 00	0 000	00 000	5 0	28 5	2 0	N. W.	60 4	*Sunshine*
11		♃ 10 39	M.	4 53	A.	♀ 2		♀ 11 59	M. 6 10	A.								
		11 7	A.	♀ 5 21	M.	♄ 29		♄ 0 21	M. ♄ 6 33	M.								
12		♀ 11 35	M.	5 49	A.			0 43	A. 6 54	A.								
		♄ 0 3	M.	♄ 6 17	M.	☉ 30		☉ 1 5	M. ☉ 7 16	M.								
13		0 31	A.	6 45	A.	*Octob.*		1 27	A. 7 38	A.								
		☉ 0 59	M.	☉ 7 13	M.	☽ 1		☽ 1 49	M. ☽ 7 59	M.								
14		1 27	A.	7 41	A.			2 9	A. 8 19	A.								
		☽ 1 55	M.	☽ 8 9	M.	♂ 2		♂ 2 29	M. ♂ 8 39	M.								
15		2 23	A.	8 56¼	A.		*New*	2 49	A. 8 59	A								
						☿ 3	1 38'. ○	☿ 3 9	M. ☿ 9 19	M.								
16																		
17																		
18																		

A Perpendicular Line divided into Signes, *ſuppoſed to be the* Periods *of the Riſings and Fallings of the Tides, as is in the other Table repreſented.*



a The Low-water.
k The Middle.
t The High-water.

Other Inquiries Concerning the Sea.

The *Publiſher* of theſe *Tracts*, knowing, that the Honorable *Robert Boyle* had not left unconſidered the Natural Hiſtory of the *Sea*, of which Subject the late, and theſe preſent Papers, have entertained the *Reader* as to the Obſervables of its *Flux* and *Reflux*; He was on this occaſion inſtant, with that Gentleman to impart to him, for publication, theſe Heads of Inquiries, he had drawn up, touching that Subject: Which having obtained (though the *Author* deſires, they may be lookt upon as unfiniſht) he thus ſubjoyns.

What is the Proportion of Salt, that is in the Water of differing Seas; And whether in the ſame Sea it be always the ſame? And if it be not, how much it differs?

What is the Gravity of Sea-waters in reference to Freſh Waters and to one another: Whether it vary not in Summer and Winter, and on other Scores? And whether in the ſame Seaſon its Gravity proceed *only* from the greater or leſſer Proportion of Salt, that is in it, and not ſometimes from other Cauſes? And what are the differing Gravities of the Sea-water, according to the Climats.*

What are the Odors, Colours and Taſts, obſervable in Sea-water?

What is the depth of the Sea in ſeveral places, and the Order of its increaſe and Decrements. And whether the Bottom of the Sea does always riſe towards the Shore, unleſs accidentally interrupted?

Of the Bottom of the Sea, and how it differs from the Surface of the Earth, in reference to the Soyl, and Evenneſs or Roughneſs of the Superficies; And the Stones, Minerals and *Vetegables* to be found there?

What the Figuration of the Seas from North to South, and from *Eaſt* to Weſt, and in the ſeveral Hemiſpheres and Climats?

What communication there is of Seas by Streights and Subterraneal Conveyances?

Of the Motion of the Sea by Winds, and how far Storms reach downwards towards the Bottom of the Sea?

Of the grand *Motions* of the Bulk or Body of the Sea; eſpecially of the Tides: Their Hiſtory as to their Nature and Differences.

* *This laſt Clauſe containing a difficult* Quære *and that may ſeem ſomething odd, Mr.* Boyl *thinks fit to note, That having recommended this matter, among others, to a learned Phyſitian, that was ſailing into* America, *and furniſhed him with a ſmall* Hydroſtaticall *Inſtrument, to obſerve from time to time the Differences of Gavvity he might meet with: This account was returned him, That he found by the Glaſs, the Sea-water to increaſe in weight, the nearer he came to the* Line, *till he arrived at a certain Degree of* Latitude; *as he remembers, it was about the* 30th; *after which, the Water ſeemed to retain the ſame ſpecifick gravity, till he came to the* Barbadoes, *or* Jamaica.

The

What power the Sea hath to produce or haſten Putrefaction in ſome Bodies, and to preſerve others; as Wood, Cables, and others that are ſunk under it?

Of the Power aſcribed to the Sea to eject Dead Bodies, *Succinum*, *Ambergris*?

Of the ſhining of the Sea in the night?

What are the Medical vertues of the Sea, eſpecially againſt *Hydrophobia*?

What is its vertue to Manure Land? And what are the Plants, that thrive beſt with Sea-water.

* *The particulars whereof (ſaith the Author) are here omitted; Sir* Robert Moray *and Dr.* Wallis *having by there more accurate Inquiries about* Tides *made them needleſs.*

Some Conſiderations

Concerning the Parenchymous *parts of the Body.*

Theſe were communicated by the inquiſitive M. *Edmund King* at the Inſtance of the *Publiſher*, as follows;

The *Parenchymous* parts of the Body, are by *Anatomiſts* generally ſuppoſed to be in very many places wholly *void of Veſſells*; deſigned chiefly to fill up Cavities and Interſtices between the Veſſels, and to bouſter up the ſame, and to convey them through the parts.

But having many years endeavoured to excarnate ſeveral parts of the Body, *viz.* the Liver, Lungs, Spleen, Kidneys, &c. (not to name the *Placenta Uteri*, which ſeems to be *Parenchymous* too;) and being very deſirous to make a *Scheme* of the Veſſels of any of theſe, what ever they were, I fixt upon; I found, notwithſtanding all my care to preſerve the Veſſels, when *I* was freeing them, as heedfully as *I* could, from the ſuppoſed *Parenchyma*, that in every breach, *I* made, either with my fingers or otherwiſe, all my endeavors were deſtructive to my purpoſe: and if, upon examination of thoſe bits, much of which is called *Parenchyma*, *I* met in them more Veſſels, than I had preſerved in the parts whence they came: And though the Portion were never ſo ſmall, yet my bare eye could make this diſcovery; much more could *I*, when aſſiſted by a *Microſcope*, perceive, *I* had deſtroyed more Veſſels than preſerved, in deſpite of the exacteſt care, *I* was capable to uſe. And being not a little concern'd, that *I* ſhould undertake to preſerve the Veſſels by ſuch a Cauſe, as *I* ſaw plainly to be their deſtruction (were the part never ſo big, or never ſo ſmall) *I* was both confounded and tired. For *I* ſaw (and ſo muſt any, that will attempt this work) in my endeavouring to preſerve one *Veſſel* of a traceable magnitude, *I* ſpoiled an infinite number of others leſs diſcernable, which were as truly *Veſſels*, as the other, differing only in ſize and figure (as to appearance.) Then reviewing what miſchief *I* had done in every place, quite through the whole *Tract* of my *Fingers*, Knife, &c. *I* began to think with my ſelf, That it was not impoſſible for theſe parts to conſiſt wholly of *Veſſels* curiouſly wrought and interwoven (probably for more Uſes, than is yet known;) And the conſideration,

tion, which came into my mind, of a piece of fine Cloth (which consists of so many several minute Hairs, call'd *Wool*) was no discouragement to this opinion. Yet I durst not be presumptuous as to indulge my self too much in it; much less to venter presently to speak of a thing, which seem'd to contradict so many Learned Men's belief. But being restless, till I might receive more satisfaction in the thing, I iterated experiments over and over; some of which prov'd so successful to my apprehension, that I was encouraged in the year 1663. and 1664. to discourse of it to several very worthy Persons, as Mr. *Boyl*, Sir *William Petty*, Dr *Williams*, Dr. *Lenthal*, Dr. *Jaspar Needham*, Dr. *Samson*, (who afterwards sent me a Letter from *France*, intimating the acquaintance he had made with the Learned *Steno*, who hath since published something of the same Discovery) Mr. *Daniel Cox*, and Dr *Samuel Parker*, &c, who doubtless cannot but remember, that then I related to them, I found much cause to believe, that that substance commonly call'd *Parenchyma*, was in most, if not in all its *Parenchymous* parts, full of Vessels; however it had been imagin'd by all, I could ever meet with, to consist in great part of a substance, in many places void of Vessels, designed for such uses, as are above mentioned.

Against which I have now further to alledge, 1. That I observe in a piece of *Musculous* Flesh (so call'd) either raw, rosted, or boiled, *&c.* that if I so far extend it, as to make it to be seen through, I can (assisting my Eye) perceive it full of Vessels placed as thick as is possible to be imagin'd, (the fat if there be any, being first removed) there appearing then nothing but vessels, yet so as with a *Microscope* may be seen through, when they are extended. 2. That, if any one, as he is at dinner, take a piece of flesh, and begin either at the head or tail of a *Muscle*, he may divide it *in infinitum*, all along from head to tail, without breaking any thing of that, called Flesh, only these transverse *Fibres*, that seem to stitch them together, and (as I am apt to think) pass through the very Bodies of the smallest of them, and quite through the whole Muscle up the Cutaneous porosities; so that there is not one of these small *ducts*, that run *per longitudinem*, but 'tis furnisht with a sufficient number of outlets, when need requires, though too minute to suffer any *alimentary* juice to pass transversly (in a living Body) or any other liquor, when the Body is dead and cold. But to wave their use at present, and to return to what I was saying, Compress between the fingers this bit of flesh, and you shall find the Juice, especially if the Meat be Hot, to go before your fingers toward either end you please; but if you compress both ends, you shall see it swell into the middle; and again, if you press the middle, it will run out at both ends. But further, suppose a piece of flesh, called *Parenchyma*, as big, or as little as you please, in any part of the Body, and let me prick it with a Needle, where you shall appoint; if you feel it, I presume you will acknowledge, a *Nerve*, or a *Fibrilla*, related to it, is touch'd: If you feel it not, I am sure some liquor either sanguineous or other, will follow the Needle: And from whence can that come, but out of Vessels? unless

accidentally

accidentally, as by a *Contuſion*, &c. it be extravaſed; in which caſe my Argument will not be injured, becauſe the part is depraved, whereas I ſpeak of the parts, as they are in their natural State.

To confirm and illuſtrate all which, I deſire, that the following *familiar* Obſervations may be conſidered:

1. If a Horſe, fat and fair to look on, without a hollow to be ſeen between his Muſcles, be rid extreme hard, and into a great ſweat, and then kept one day without water or moiſt meat, you ſhall ſee him look ſo thin in many places as in the *muſculous* parts, that you will hardly believe it to be the ſame Horſe, eſpecially if he be (as the Phraſe is among Horſe-maſters) a *Naſh* or *Waſh-Horſe*. The cauſe of which thinneſs will eaſily be granted to be only an exhauſtion of Juice, expended out of the Blood, which did ſtuff out theſe Veſſels. And whoever, that is uſed to ride hard, ſhall obſerve, how thick this foul Horſe breaths, and at what a rate he will reek and ſweat, will not much wonder at the alteration. But if the Horſe be a hardy one, and uſed to be hard ridden, then you will ſee, that one days reſt, and his belly full of good meat and drink, will in one day or two almoſt reſtore him to his former plight, the food being within that ſhort ſpace of time ſo diſtributed, that all the Veſſels will be repleniſh'd again, as before. And the cleaner the Horſe is, the ſooner recruited, and the leſs ſign of hard riding will appear. This ſeems to ſhew the facility, with which the Juice, called Blood, paſſeth; Which ſurely, if there were ſuch a thing as a *Parenchyma*, might by ſeveral accidents (not difficult to mention) be ſo depraved in ſeveral parts of it, that it might loſe its receptive faculty; than which it may be thought to have none of greater uſe, being ſuppoſed to be without Veſſels.

2. Diſcourſing ſometimes with *Graſiers* in the Country, about the Paſture of Cattle, I have been informed by them, that, if they buy any Old Beaſts, Oxen, or Cows, to feed, they chooſe rather thoſe that are as poor, as can be, ſo they be ſound; becauſe that, if they are pretty well in fleſh, what they then add to them by a good paſture, though it make them both look and ſell well, yet it will not make them eat ſo well, their fleſh proving hard and very tough: Which ſome may ſuppoſe to be the age of *Parenchyma*; and ſo it is of that ſo called. But if thoſe Beaſts be old and extremely poor, then they feed very kindly, and will be not only very fat, but ſpend well, like young ones, and eat very tender.

Of which I take the reaſon (excluding a *Parenchyma* now) to be this. When an Oxe or a Cow is grown old, and in an indifferent plight as to his *fleſh* (for ſo it is call'd) all thoſe *Veſſels* having been kept at that ſize for the moſt part, have contracted a tenſeneſs and firmneſs, and their *fibers* leſs extenſive, not ſo fitted for the reception of more unctuous particles to relaxe them: and that additional unctuous matter, which occaſions fatneſs, is forced to ſeek new quarter, any where (often remote from Muſcles) where it can be with leaſt difficulty received; ſometimes to one place, ſometimes to another

ther, as may be ſeen in Shambles: Whereas, if there were ſuch a thing as a *Parenchyma*, that certainly would, like a hungry Sponge, immediately ſwell up in ſeveral parts, (which without much difficulty might be diſcover'd in diſſection) and more eminently, where it ſhould find the pores moſt patent: And in the diſſection of ſuch Muſcles it would be very ſtrange, not to find ſome, if not many, pieces of them in various ſhapes, to the great inconvenience of the parts, in which they are ſeated: Which yet I confeſs I could never find in any Muſcle, unleſs it were where there had been a *Contuſion*, or an *Impoſtume*, or the like. But according to my opinion of the *Parenchymous* parts, the reaſon, why the Fleſh of a very lean Oxe or Cow, that hath got new Fleſh in a good paſture, eats tenderer, ſeems to be this: That in a very lean Beaſt the Veſſels deſſeined for admitting and diſtributing the nouriſhing Juice, are ſo near contracted, and lye ſo cloſe together, that, when once they are relax'd, by the freſh and unctuous nouriſhment, they extend every way in all *extenſive* parts, until in a ſhort time the whole Creature is, as it were, created a new, having got new fleſh upon old bones: And the neceſſity of extreme extenſion makes all thoſe parts, that are, as has been ſaid, for the admiſſion of nouriſhment, ſo thin and fine, that it will make the lean Beaſt, put into a rich paſture, eat young and tender: Whereas one of the ſame Age, that never was very poor, fed in the ſame paſture, ſhall eat hard and tough.

3. It has been obſerved, that Corpulent Perſons in ſome Diſeaſes, that ſeize on them, do fall away to wonder, not only in the Waſt, but in the Arms, Legs, and Thighs; and the very Calves of the Legs have been obſerved ſo flaccid and looſe, that one might wrap the skin about the bones. The reaſon whereof, according to the opinion deliver'd, may be eaſily rendred to be, A great Conſumption of the Stock of Liquors, that in Health kept the Veſſels turgid; Which Veſſels I ſuppoſe to make up thoſe Muſcles. But when the Pores are obſtructed, that the nouriſhment is hindred (which then alſo uſes to be but ſparingly adminiſtred) and ſweats, either ſpontaneous, or forced, are large, there muſt needs be a great expence of thoſe Liquors, the ſupply being but inconſiderable: which cannot but contract all theſe ducts of all ſorts nearer together, and make them much leſs in themſelves, meerly from Exhauſtion: Or, if there ſhould be no ſweats, the internal Heat ſpends the ſpirits, and dries up the Liquors; the conſequence whereof may reaſonably be preſumed to be this Flaccidity of parts, and great and ſudden Change, made in them; not that there is need of any *Parenchyma* to fill up theſe Muſcles, conſidering what hath been ſaid. Mean while, I humbly conceive, that if it be in any part of a Muſcle, their Ingenuity, that plead for it, will put them upon ſome experimenrs, to bring it to Ocular Demonſtration, either in a Living or Dead Muſcle, any kind of fleſh, raw, roſted, boyl'd, or in what they can beſt make it out. And when I ſhall be convinc'd of an Errour in what I have diſcourſed, I ſhall beg pardon for giving the Occaſion of the trouble of that Experiment, which ſhall prove a

Parenchyma in any Muſcle; and think my time well ſpent in receiving a full ſatisfaction of the ungroundedneſs of my opinion; and readily ſubmit to the Author, with a grateful acknowledgement of my Obligation to any one, that ſhall rectifie me in my miſtake, if it be one.

Obſervables

Touching Petrification.

THough much hath been already ſaid and written of *Petrification*, yet 'tis conceived, that all that comes ſo far ſhort of a competent ſtock for the compoſing of a perfect *Hiſtory of Petrification*, that the incompleteneſs thereof ought to awaken the more diligent attention of the Curious, and to call in their aid for Additions, thereby ſo to increaſe and to complete the *Materials* for that work, that it may the better ſerve to clear and make out the Cauſe of that Tranſmutation. And that the rather, becauſe if it lay in the power of humane Skill (by the knowledge of *Nature*'s works) to raiſe *Petrification*, or to allay, or prevent it, or to order and direct it (which perchance in time might be attained the ſaid way) much uſe might be made of this Art; eſpecially if it could be made applicable to hinder the Generation of the Stone and Gravel in humane Bodies, or to diſſolve the Stone, where 'tis formed; beſides other valuable Uſes, that might be excogitated.

Upon this Conſideration, care *is*, and further *will be* taken in theſe Papers, to record, among other Obſervables of Nature, what ſhall be communicated of this kind of *Change*.

In *Numb.* 1. 2. and 5. ſeveral Relations have been made belonging to this Argument. Much of it, together with conſiderable Reflections may be ſeen in Mr. *Boyle*'s *Eſſay* of *Firmneſs*: In *Helmont de Lithiaſi*, where, among other remarques, is recited the Teſtimony of *Paræus*, of a *Petrified Child* ſeen at *Paris*, and by the Owner uſed for a *Whetſtone*: In *Deuſingius*'s Hiſtoria *Infantis in Abdomine inventi*, & *in duritiem lapideam converſi*: In Mr. *Hook*'s *Micrography*, and in others. To omit now, what has been related (but perhaps not well enough atteſted) by Authors, concerning the ſtupendious Petrifications of whole Companies of Men, and Troops of Cattle; by *Aventinus* lib. 7. *Annal. Bojorum*; by *Purchas* in his *Pilgrimage* p. 426. in fol. printed at *London* 1614. and, (of a Troop of *Spaniſh* Horſemen) by *Joſ. Acoſta* lib. 3. c. 9.

To all which, the Curious Dr. *Beale* now adds a Narrative of a Stone, not long ſince taken out of the Womb of a Woman of his neighbourhood neer *Trent* in *Somerſetſhire*, by inciſion, and afterwards perfectly cured, though ſhe had born the Stone with extreme torments for 8. or 9. years. The operation he relates to have been made in *Eaſter* laſt; after which time, he affirms to have ſeen the Stone, and weigh'd it in Gold-Scales, where it wanted ſomewhat of four Ounces, but had loſt of the weight, it formerly had, being

being very light for a Stone of that Bulk. He further deſcribes it to be of a whitiſh colour, lighter than Aſh-colour; perchance (*ſaith he*) not unlike to that recited out of *Scaliger* by M. *Boyle* in his *Eſſay of Firmneſs* pag. 238. *qui aëris contactu poſtea in gypſeam tum ſpeciem tum firmitatem concreverat.* It had no deep aſperities, and had ſomewhat of an Oval figure, but leſs at one end, than a Hen-Egge, and bigger and blunter at the other, than a Gooſe-egge.

This Stone (ſo he concludes) is intended for the *Royal Society*, with the Teſtimony of the *Chirurgion*, that perform'd the Operation, and other Witneſſes of ſpecial credit; where alſo will be annexed the *manner* of Operation.

It appears by this laſt clauſe (to add that on this occaſion) that this Well-wiſher to the Improvement of all uſefull knowledge, has taken notice of that conſiderable *Collection of Curioſities*, lately preſented to the lately nam'd Society for their *Repoſitory*, by that Publick-minded Gentleman Mr. *Daniel Colwall*, a very worthy and uſeful Member of that Body: To which Repoſitory whatſoevet is preſented as rare and curious, will be with great care, together with the *Donors names* and their *Beneficence* recorded, and the things preſerved for After-ages, (probably much better and ſafer, than in their own private Cabinets;) and in progreſs of Time will be employed for conſiderable Philoſophical and Uſefull purpoſes; of which perhaps more largely in another place.

A Relation
Of a kind of Worms, *that eat out Stones.*

This is taken out of a Letter, written by one *M. de la Voye* to M. *Auzout*, to be found in the 32. *Journal des Scavans*; as follows.

IN a great and very ancient Wall of Free-Stone in the *Benedictins Abby* at *Caen* in *Normandy*, facing Southward, there are to be found many Stones ſo eaten by Worms, that one may run his hand into moſt of the Cavities; which are variouſly faſhion'd, like the Stones, which I have ſeen wrought with ſo much Art in the *Louvre*: In theſe cavities there is abundance of live-Worms, their excrement, and of that Stone-duſt, they eat. Between many of the Cavities there remain but leaves, as it were, of Stone, very thin, which part them. I have taken ſome of theſe living Worms, which I found in the eaten Stone, and put them into a Box with ſeveral bits of the Stone, leaving them there together for the ſpace of eight dayes; and then opening the Box, the Stone ſeem'd to me eaten ſo ſenſibly, that I could no longer doubt of it. I ſend you the Box and the Stones in it, together with the living Worms; and to ſatisfie your Curioſity, I ſhall relate to you, what I have obſerved of them, both *with* and *without* a *Microſcope*.

These Worms are inclosed in a Shell, which is grayish, and of the bigness of a Barly-corn, sharper at one end, than the other. By the means of an excellent *Microscope* I have observ'd, that 'tis all overspread with little Stones, and little greenish Eggs; and that there is at the sharpest end a little hole, by which these Creatures cast out their excrement, and at the other end, a somewhat bigger whole, through which they put out their heads, and fasten themselves to the Stones, they gnaw. They are not so shut up, but that sometimes they come out, and walk abroad. They are all black, about two *Lines* of an Inch long, and three quarters of a *Line* large. Their Body is distinguish't into several plyes, and near their head they have three feet on each side, which have but two Joints, resembling those of a Lowse. When they move, their Body is commonly upwards, with their mouth against the Stone. They have a big head, somewhat flat, and even, of the colour of a Tortoise-Shell, brauniſh, with some small white hair. Their mouth is also big; where may be seen four kinds of Jaw-bones, lying crossewise, which they move continually, opening and shutting them like a pair of *Compasses* with four branches. The Jaws on both sides of the month are all black; the nether-Jaw hath a point like the Sting of a Bee, but uniform, They draw threds out of their mouth with their fore-feet, using that point to range them, and to form their Shells of them. They have Ten Eyes, very black and round, which appear to be bigger than a Pins-head. There are five of them on each side of the head, standing after this manner

But besides these Worms, I have found; that *Mortar* is eaten by an infinit number of small Creatures, of the bigness of Cheese-Mites. These have but two Eyes, and are blackish. They have four feet on each side pretty long. The point of their Muzzel is very sharp, as that of a Spider. I send you but one of them, though I had abundance, but they are dead and lost. It may be, you'l find some at *Paris*, seeing that in the old Mortar betwixt Stones, that is found in Walls made with rubbish, there is great store of them, together with great plenty of their little Eggs. I have not yet examined, whether these be those, that in the surfaces of all the Stones, where they are met with, make little round holes, and small traces and impressions, which make them look like *Worm-eaten Wood*. But 'tis probable, they are such. It should be observed, whether these Worms do not take Wings, and all the other appearances of Cater-pillars; and whether they are not to be found in Plaister, that is full of holes, in Bricks, in Greety Stones, and in Rocks.

You may observe more of them in Walls exposed to the *South*, than in others; and that the Worms, that eat the Stone, live longer, than those, that

that eat the Mortar, which keep not above eight dayes alive. I have obſerved all their parts with a very good *Microſcope*, without which, and a great deal of attention, 'tis difficult to ſee them well.

I have ſeen other very old Walls altogether eaten, as thoſe of the *Temple* at *Paris*, where I could find no Worms, but the Cavities were full of Shells of various kinds, diverſly figur'd and turn'd: all which I believe to be little Animals petrified.

Some promiſcuous Obſervations, made in Somerſet-ſhire, *and imparted by the above-mention'd Dr.* Beale.

His words are theſe, in a Letter to the *Publiſher*, of the 24. *Septemb.* 1666. at *Yeovill* in *Somerſetſhire*;

I have two or three remarks, perhaps not unworthy to be recorded for further application in like caſes of time and place.

1. In the Moores from hence towards *Bridgewater*, in the extreme drought, we have endured this Summer, ſome lengths of paſture grew much ſooner withered and parched, than the other paſture. And this parched part ſeem'd to bear the length and ſhape (in groſſe) of Trees. They digg'd, and found, in the place, *Oakes* indeed, as black as Ebony. And hence they have been inſtructed to find and take up many hundreds of Oakes, as a neighbour of good credit aſſures me. This advertiſement may be inſtructive for other parts, as *Kent*, *Eſſex*, *Lincoln*, &c.

2. My Coſen *Philips* of *Montague* has in his paſtures of *Socke*, about three miles off, a large Pool, to which Pigeons reſort; but the Cattle will not drink of it, no not in the extream want of water in this drought. To the taſte it is not only brackiſh, but hath other loathſome taſts. In a Venice-glaſs it looked greeniſh and clear, juſt like the moſt greeniſh Cider as ſoon as it is perfectly clarifyed. I boyl'd a Pint of it in a Poſnet of Bell-Mettall (commonly uſed to preſerve Sweatmeats:) ſuddenly it yeilded a thick froth, whence I ſcumm'd half a ſcore Spoonfulls; of which the incloſed is a part. *Suffring the water to be boyl'd all away, it left much of the ſame on the ſides and bottom of the Poſnet.

* *This had ſomewhat of a Vitriolate taſte. But the Experiment being made with greater quantities of this water, which queſtionleſs will be done, the nature and kind of it may be better known.*

3. From *Lamport*, towards *Bridge-water*, Eeles are ſo cheap in the froſts of Winter, that they vend them for little. Their abundance is from hence, that as the people walk, in the froſty Mornings, on the banks of the river, they diſcern, towards the edges of the banks, ſome parts *not hoare*, as the reſt, but *green*; where ſearching the holes of the banks, they find heaps of Eeles.

A Problem
For finding the Year of the Julian Period *by a new and very easie Method.*

THis occurs in the *Journal des Scavans* n°. 36. as it had been propoſed and communicated by the Learned *Jeſuit DE BILLY*. viz.

Multiply the *Solar* Cycle by 4845. and the *Lunar*, by 4200. and that of the *Indiction*, by 5916. Then divide the Sum of the products by 7980. which is the *Julian Period:* The *Remaindr* of the Diviſion, without having regard to the *Quotient*, ſhall be the year enquired after.

E. g. Let the Cycle of the *Sun* be 3; of the *Moon* 4; and of the *Indiction* 5. Multiply 3. by 4845, and you have 14535; and 4. by 4200, comes 16800; and 5. by 6916, comes 34580. The Sum of the products is 65915, which being divided by 7980. gives 8. for the *Quotient*, and the number 2075, which remains, is the Year of the *Julian Period.*

Some learned Mathematicians of *Paris*, to whom the ſaid *P. de Billy*. did propoſe this *Problem*, have found the Demonſtration thereof; as the ſame *Journal* intimates.

An Account
Of ſome Books, not long ſince publiſhed.

I. TENTAMINA PHYSICO-THEOLOGICA DE DEO, *Sive* THEOLOGIA SCOLASTICA, *ad Normam Novæ & Reformatæ Philoſophiæ concinnata, & duobus libris comprehenſa. Quorum altero, de Dei exiſtentia adverſus Atheos et Epicureos ex ipſorummet Principiis diſputatur; altero, de Ejuſdem Eſſentia & Attributis; primò, ſecundùm Theologiam Ethnicam, ubi explicatur, Quantum hactenus Alii in Gentilium ſententiis, de ſummi Numinis Naturæ eruendis, hallucinati fuerint; deinde ſecundum Theologiam Chriſtianam: Et quid de Divina Eſſentia ac Attributis ſtatuendum ſit, deſſeritur. Quibus proſtremò accedit ſpecialis Diſſertatio de Primo Numinis Attributo, ÆTERNITATE.* Authore *Samuele Parkero*, A. M.

This Treatiſe, publiſh'd the laſt year, would ſooner have been taken notice off in theſe *Tracts*, had it not eſcaped the *Publiſhers* view till of late, when he, upon ſerious peruſal, found it very worthy the recommending it to all ſorts of perſons, and particularly to thoſe, who either pleaſe themſelves with that fond opinion, *That Philoſophy is the Apprentiſhip of Atheiſme*; or hearken to the aſperſions, that are generally laid upon the *Reformation* of *Philoſophy.*

This excellent piece removes both theſe; and being joyned and compared with the truly Noble Mr. *Boyle's* Conſiderations in his *Firſt Part* of the

Uſeful-

Uſefulneſs of Experimental-Natural Philoſophy, will ſtrongly evince, How Much that Philoſophy, which ſearches out the real Productions of Nature (the true Works of God) does manifeſt the Divine Glory more, than the Notionals of the Gentils.

This Author (now a Fellow of the *Royal Society*) delivers his Matter in two Books.

Lib. 1. Cap. 1. Atheiſts are diſappointed of the Authority of *Epicurus*, and of other Antient Philoſophers, for their groſs Atheiſme.

Cap. 2. The beautifull Frame of the World evinceth the Architectonical Author and Governor.

Cap. 3. The admirable Contrivance in the Structure of Mankind, and of Animals, does more conſpicuouſly ſhew the Deity.

Cap. 4. The Atheiſt caught in his one Net, or convinced by the true force of his own Arguments.

Cap. 5. The Arguments deviſed againſt Atheiſts by *Des Cartes*, and drawn from the *Idea's* of our Mind, examin'd and found imperfect and invalid.

Lib. 2. Cap. 1. The Opinions of the Gentils concerning God, unduly applyed to the *Deity*, which we worſhip; but properly to be underſtood by them of the *Sun*, or of the *Soul of the World*.

Cap. 2. More expreſly proved, that the Antient Philoſophers conceived, the *Soul of the World* to be God.

Cap. 3. The Hiſtorical Theology of the Gentils for the moſt part is unduly applyed or accommodated to the Holy Scriptures.

Cap. 4. The Divine Subſtance, Immenſity, Incomprehenſibility, Inviſibility, explicated, as far as our weak reaſon does reach.

Cap. 5. The Divine Perfections, and other Attributes and Affections, how far explicable.

Cap. 6. The Eternity of God, how apprehended.

Theſe are in ſhort the Heads of the Book, which is yet but in Latin. It were to be wiſht, the Authour would make it ſpeak his own lively *Engliſh*.

II. HONORATI FABRI *Soc. Jeſu Theologi, Tractatus duo; quorum Prior eſt de Plantis et de Generatione Animalium; Poſterior, de Homine.*

As the Matter of this Book is conſiderable, ſo is the order and dependence of all its parts excellent; in regard that all the Propoſitions are ranged according to a Geometrical method, and ſo well diſpoſed, that the latter do always ſuppoſe the former, and ſeem to depend all of them upon certain evident principles, whence they flow by a natural conſequence.

This *Volume* contains two Treatiſes.

The *Firſt* is divided into 5. Books. In the *four firſt*, he treats of *Plants*, and diſtributes them into three *Claſſes*; ſome growing *in the Earth*, as *Trees*; others, growing *upon Plants*, as *Moſſe*; and a third ſort, growing *upon Animals*, as *Hair*, *Horns*, and *Feathers*. He examins and conſiders the

Parts

Parts of all these Plants and their Use, the manner, how they are produced, and nourished; and their different Qualities. He discourses also of Bread, Wine, Oyle, and the other Mixtes, that are made of Plantes.

In the *Fifth Book*, he treats of the *Generation of Animals*, where he delivers many curious matters, explicating in a very easie and familiar way that Argument, which hath alwayes been lookt upon, as one of the obscurest in Natural Philosophy.

The *Second* Treatise consists of 7. Books; wherein the Authors considers, what appertains to *Man*. He discourses *first*, of Digestion, of the Circulation of the Bloud, and of the Use of the principal parts of the Human Body. *Next*, he treats of the Senses, External and Internal; of all he Motions of the Body, both Natural and Voluntary; of the sensitive Appetite, and the Passions; *Thence* he proceeds to the Temperaments, Habits, Instinct, Sleep, Sickness, *&c.* *Lastly*, passing to the *Rational Soul*, he endeavours to demonstrate the Immortality thereof, and to explain also the Manner, how it worketh upon the Body, and is united with the Body; where he omits not to reason of all the Powers of the Soul, of Liberty, and of the Operations of the Understanding and Will.

In *general*, the Authour makes it his study, for the explicating of the most perplext Difficulties, to shew, that Nature works not but by very simple and easie wayes.

In *particular*, he interspersses several curious remarks. *E. g.* He teaches how to make *Perspectives*, that magnifie Objects, without Glass; telling us, that when an Object is look't upon through a small hole, it appears much greater than it is; and that therefore, if instead of Glasses one did cast before ones eyes two *Plates* having little holes in them, it would furnish us with a new kind of *Perspectives*, more commodious than those of Glasses, which spoil the Sight by reason of the refraction of the Rayes, caused thereby. *Again*, He renders the cause of that common, but surprising, effect of Painters, drawing certain Pourtraictures, which seem to look directly upon all their Beholders, on what side soever they place themselves: *Videl.* That in those Pictures, the Nose is a little turned to one side, and the eyes to the other. Whence it comes, that such Pictures seem to look to the right side, because the Eyes are indeed turned that way; but they appear also to look to the left, because the point of the Nose is turned that way, and the Table, whereon the Picture is drawn, being flat, the Looker on perceives not, that the Eyes are turned th'other way; which he would do, if the Eyes of the Pourtraict were convexe: Whence it comes, that no Figure can be made embossed which looks every way.

The art, which he teaches of making *Parsley* shoot out of the ground in a few hours, is this. Infuse the seed of it in Vineagar; and, having sown it in good ground, cast on it a good quantity of the Ashes of Bean-Cods, and sprinkle it with Spirit of Wine, and then cover it with some linnen. He mentions also, that if you calcine Earth, and then water it well, it will produce

produce a great variety of different Herbs; and that the Ashes of Corn burnt, being sown, have sometimes produced other Corn.

To add that by the by, This Author is not so addicted to *Aristotle*, as to be on his side, when he thinks Truth is not. He hath emancipated himself considerably from the *Scholastick* way of Philosophing. He dares maintain, that the Vegetative and Sensitive Souls are not *Substantial* Forms; and that it is with Plants and Animals, as with Artificial things, the Form whereof results from the Union and Disposition of the parts. According to this *Hypothesis*, he explicates all the Operations of Plants and Animals, without having any recourse to the Soul. He avers also, that there are no *Species Intentionales*, and no Habitudes, and that the Animal Spirits, which Philosophers commonly believe to be necessary for all the Operations of Life, are useless.

It might also be observed out of this Author, what he discourses of the Generation of Animals by Putrefaction; of the Cause of Intermittent *Feavers*, and of the Animal instinct, and of many other particulars; were it not better to refer the Curious to the Book it self.

III. *RELATION DU VOYAGE de l' Eveque de Beryte, par la Turquie, la Perse, les Indes*, &c. *jusques au Royaume de Siam, & autres lieux*; par M. *de Bourges, Prestre* &c.

This Author imploying his Pen chiefly, according to his design, to give an Accompt of the Success, the Undertakers of this Voyage had, in propagating the Christian Faith in the remoter parts of the World, and relating on that occasion, What number of Churches they have Founded in *Cochin-China*, and the Kingdome of *Tonquin* (in which latter alone he affirms, that there are more then three hundred thousand Christians;) Being, I say principally intent upon that Subject, he seems not to have made many Philosophical observations in those places. Mean while he does good service to those, that have occasion to travel into the *East-Indies* mostly by Land, by describing the passage, they took thither; which was, That they embarqued at *Marseilles*, in *September*, the most convenient and favourable season for that Voyage; whence Ships do ordinarily pass every Month from *Syria*, reckoning one Month for the time of Sayling to *Alexandretta*. Thence to *Aleppo*, counting one month more for the Stay, to be made there to meet the *Caravane* for *Babylon*, and six weeks more for the march from *Aleppo* to *Babylon*; where a fortnight will pass, before an opportunity happen to embarque upon the *Tyger* for *Balsora*; which Journey will require a fortnight more. And about this time it will be neer the end of *January*. Thence is always conveniency to pass to *Congo*, 4. days Journey from *Comoron* or *Gombroun*; to which latter part there is also frequent occasion to pass by sea from *Balsora*, which will take up some 15 or 16. days Sail. There (vid. at *Comoron*) you will every year meet with *English*, *Portugal*, *Dutch*, and *Morish* Vessels, for *Surate*, from *October* till the end of *April*; for they are obliged to be at *Surate*, before the end of *May*, because all the ports of those

Indies are ſhut the 4. enſuing months, by reaſon of the danger of that Sea.

But beſides this Direction, the Book is not quite deſtitute of *Natural* Obſervations. It relates, 1. How Diamonds are found and ſeparated in *Golconda*; They take of the Earth, held to be proper to form them, which is reddiſh, and diſtinguiſh'd with white veins, and full of flints and hard lumps. Then they put near the places, which they will digge, a cloſe and even Earth; and to it they carry thoſe Earths, they have digged out of the Mine, and gently ſpread it abroad, and leave it expoſed to the Sun for two days. Then being dryed enough they beat it, and ſifting this Earth, they find the Diamonds in aſhes of Flints, in which Nature hath ſet them. Here he adds, that the King of that Country farms out theſe Diamond-Mines for 600000. Crowns *per annum*, reſerving to himſelf the right of all the Diamonds, that exceed ten *Carats* in weight: There are Diamonds, that mount to 35. and 40 *Carats*. And this is the great Treaſure of that Prince.

2. That the moſt eſteemed fruit in thoſe parts, the *Durion* (of the bigneſs and ſhape of an ordinary *Melon*) has a very unpleaſing and even untollerable ſmell, like to that of a rotten *Apple*.

3. That *Rice* proſpers moſt in wateriſh grounds; and that the fields, where it grows beſt, reſembles rather to Mariſhes, than to any ploughed Soyle: Yea, that that Grain has the force, though 6. or 7. foot water ſtand over it, to ſhoot its Stalk above it; and that the Stem, which bears it, riſes and grows proportionably to the height of the water, that drowns the field.

4. That the way of keeping ones ſelf harmleſs from a wild *Elephant*, when he runs directly upon one, is, to hold ſomething to him; as a Hat, a Coat, a piece of Linnen, which he ſeiſes on with his Trunk, and playes with it, as if he were pleaſed with this apparent homage, done to him; and ſo paſſes on. If he be in a rage, that then the only remedy is, to turn inceſſantly behind him to the left ſide, in regard that naturally (*ſaith this Author*) he never turns himſelf that way, but to the right: And the time, there is to turn, becauſe of the Beaſts unweildineſs, affords leiſure enough to climbe up ſome high Tree, or to mount ſome ſteep ground: all which if it fail, by holding always his tail, and turning with him, the Animal will be tired, and give opportunity to eſcape.

LONDON,
Printed for *John Crook* in *Duck-Lane* neer *Little-Britain*. 1666.

PHILOSOPHICAL TRANSACTIONS.

Munday November 19. 1666.

The Contents.

An Addition to the Inſtances of Petrification, *formerly enumerated. Articles of* Inquiries *concerning* Mines; *as, to the neighbouring Country about them; the Soyl where they are; the Signes of them; the Structure and other particulars belonging to the Mines themſelves; the Nature and Circumſtances of* Ore; *and the Reduction of* Ore *into* Metal. *Promiſcuous* Inquiries *formerly recommended to Monſieur* Heuelius, *particularly about* Cold; *together with his own, and his Correſpondents* Anſwer *to ſome of them. The ſucceſs of the Experiment of Transfuſing the Blood of one Animal into another.*

An Addition to the Inſtances *of* Petrification, *enumerated in the laſt of theſe* Papers.

This Inſtance *was ſome while ſince communicated to the* Royal Society *by that Ingenious Gentleman Mr.* Philip Packer, *a worthy Member of that Body; in theſe words;*

ON a Bank in a Cloſe of Mr. *Purefoy*, neer his houſe, call'd *Wadley*, a mile from *Farrington* in *Berks*, there grows an *Elme*, which hath now loſt the top, and is grown hollow, containing neer a Tun of Timber. From the But of the ſame Tree, one of the ſpreading Clawes having been formerly cut off with an Axe; that part of the But, from whence the ſame was ſever'd, being about 1½ foot above ground, and inward within the trunk

of the Tree, hath contracted a petrfied Cruſt, about the thickneſs of a *ſhilling*, all over the woody part within the Bark; the Marks of the Axe alſo remaining very conſpicuous, with this petrified cruſt upon it. By what means it ſhould thus happen, cannot well be conceived, in regard there is no water neer it; the part, above the ground and out of the weather; the Tree yet growing: unleſs being cut at ſome ſeaſon, when the ſap was flowing, the owſing of the ſap might become petrified by the Air, and the Tree grow rotten and hollow inward ſince that time; which how long ſince, is not known.

A piece of that part cut, was preſented, together with this Account, to the ſaid *Society*, for their *Repoſitory*.

Articles of Inquiries touching Mines.

What the Honourable *Robert Boyle* gave the Reader cauſe to hope for, in *Numb.* 11. when he was pleaſed to impart thoſe *General* Heads for a Natural Hiſtory of a Country, *there* publiſh'd; He is not un-mindful to perform, by enlarging them as occaſion ſerves, with *Particular* and *Subordinate* Inquiries. Here he gratifies the Curious with a conſiderable Set of Inquiries about *Mines*: which though unfiniſh'd, yet the *Publiſher*, was inſtant to obtain their preſent Publication, to the end, that he might the more conveniently recommend them to ſeveral Forreigners of his Acquaintance, now ready to return to their ſeveral Countryes, which he underſtands to abound in Mines; and from the Curious Inhabitants whereof, he expects to receive a good Accompt upon ſome at leaſt of theſe Inquiries; which alſo by ſeveral of them have been earneſtly deſired, as Inſtructions, to direct them, what Particulars to inquire after upon this Subject.

Theſe Quæries are reduced by the *Author* to ſix Heads:

The *firſt*, The neighbouring Country about the Mines.

The *ſecond*, The Soyl where the Mines are.

The *third*, The Signs of Mines.

The *fourth*, The Structure and other particulars belonging to the Mines themſelves.

The *fifth*, The Nature and Circumſtances of the Ore.

The *ſixth*, the Reduction of the Ore into Metal.

Quæriꝰ

QUÆRIES
About the first Title.

1. Whether the Country be Mountainous, Plain, or distinguish'd with Vales? And in case it be mountainous, what kind of Hills they are; whether high, or low, or indifferently elevated? Whether almost equal or very un-equal in height? Whether fruitful or barren; cold or temperate; rocky or not; hollow or solid? Whether they run in ridges, or seem confusedly placed; and, if the former, what way the ridges run, North and South, *&c.* And whether they run any thing parallel to one another?

2. Whether the Country be barren or fruitful? And, if any way fruitful, what it produces, and what it most abounds with?

3. What Cattle it nourishes, and whether they have any such thing peculiar in point of bigness, colour, shape, longævity, fitness or unfitness to make good meat, *&c.* as may be rather adscribed to the peculiar nature of the place, than to the barrenness of the Soyl, or other manifest causes?

4. Whether the Natives, and other Inhabitants, live longer or shorter than ordinary? Whether they live more or less healthy? Whether they be subject to any *Epidemical* Diseases, that may very probably be imputed to the Mines; and what these Diseases are; and what Remedies are found successful?

5. Whether the Country be, or be not furnish'd with Rivers, Brooks, Springs, and other Waters; and how these waters are conditioned?

6. Whether the Air be dry or moist; hot or cold; clear or foggy; thick or thin; heavy or light; and especially, whether the Weather be more or less variable than ordinarily; or whether it be subject to great and sudden changes, that may probably be imputed to the Mineral and Subterraneous Steams; and what they are?

About the ſecond Title.

7. Whether the *Soyle* that is neer the Surface of the Earth, be Stony; and, if it be, what kind of Stones it abounds with? Whether it be Clayie, Marley, Chalkye, *&c.* And, if it be of ſeveral kinds, how many they are; and by what properties they are diſtinguiſh'd?

About the third Title.

8. By what *Signs* they know or gueſs, that there is a Mine in ſuch a place?

9. Theſe Signs are *either* upon the Surface of the Earth, *or beneath* it.

To the *former* belong theſe *Quæries.*

10. Whether the Ground be made barren by Metalline or Mineral Effluviums?

11. Whether it be obſerved, that Trees and other greater Plants ſeem to have their tops burnt, or other leaves or outſides diſcoloured? or whether there be any Plants, that do affect to grow over ſuch Mines; and whether it have been tryed, that other Plants, that would proſper in the adjacent places, will not be made to grow or thrive there?

12. Whether the Stones and Pebles, that are waſh'd by the Brooks, Springs, or other Waters, have any colour'd ſubſtance left upon them; and if they have, of what colour, weight, *&c.* theſe adherences are?

13. Whether the Waters of the place propoſed, do by their taſt, ſmell, ponderouſneſs, *&c.* diſcloſe themſelves to contain Minerals? And, if they do, what Minerals they or their reſidences, when they are evapourated away, do appear to abound with, or to participate of?

14. Whether *Snow* will not lye, or *Froſt* continue ſo long, or *Dew* be generated or ſtay upon the ground in the place propoſed, as on other neighbouring grounds?

15. Whether the *Dew* that falls on that ground, will diſcolour white Linnen or Woollen-Cloths, ſpred over night on the ſurface

ſurface of the ground, and employed to collect the Dew? And whether the *Rain* that falls there, and may be ſuppoſed to come thither from elſewhere, will diſcolour ſuch Clothes, or afford any reſidence of a Mineral Nature?

16. Whether the Place be more than ordinarily ſubject to Thunder and Lightning, and to ſudden Storms or Earthquakes; as likewiſe to Nocturnal Lights and fiery Meteors.

17. Whether Miſts uſe to riſe from Grounds ſtored with Minerals? What is obſervable in them, and what Minerals they ſignify, and may be ſuppoſed to be produced by?

18. Whether the *Virgula Divinatoria* be uſed to find out the Veins of propoſed Mines; and, if it be, with what ſucceſs?

19. What other Signs above ground afford probability of Mines, or Direction for following a Vein over Hills, Valleys, Lakes, Rivers, *&c.*

The *ſecond* ſort of *Signs* belonging to theſe *Quæries*, are ſuch as follow.

20. Whether there be any Clayes, Marles, or other Mineral Earths, yellow or liquid matters, that uſually give notice of the Ore? And if there be more than one, how and at what depths they are wont to lye reſpectively? Of what thickneſs and conſiſtence they are; and in what Order the Diggers meet with them?

21. Whether there be any Stones or *Marchaſites* to be found neer, or not very far from the ſurface of the ground, by which one may have ground to expect a Mine? As is often obſerved in the Tin-Mines of *Cornwall*, over which ſuch kind of Stones are divers times found lying above ground?

22. Whether all Stones of that kind do equally ſignify that Mine? And, if not, how the ſignificant Stones are to be known, as by Colour, Bigneſs, Shape, Weight, Depth under ground, *&c.*

23. Whether there be any Earths of peculiar kinds, as to Colour, Conſiſtence, *&c.* that indicate a Mine beneath or near them; and, if there be, what they are, and what is their conſecution, if they have any?

24. Whether Heat or Damps give any aſſurance or a probability of finding a Mine?

25. Whether

25. Whether Water of any kind, met with in Digging, eſpecially at this or that depth, do betoken a Mine?

26. Whether there be any Signs of the neerneſs of the Mine, and what they are?

27. Whether there be any Signs of ones having miſs'd the Mine, either by being paſt above, or beneath, or having left it on either hand; and what they are?

28. Whether there be any Signs not only of the diſtinct and determinate kind of Metals or Minerals; but of the Plenty and Goodneſs of the Vein; and what they are?

29. Whether there be any Signs of the depth of the Vein beneath the ſurface of the Earth; and what they are?

30. Whether there be any proper or peculiar Signs, that ſhow it to be hopeleſs, or at leaſt unlikely, to find a Vein in the place where it is digg'd for; and what thoſe are?

About the fourth Title.

31. What is the depth of the Shaft or Groove (which though named in the *ſingular* Number, the Queſtions about it are *generally* applicable) till you come at the Vein or Ore?

32. Whether the Vein run or lye Horizontal, or dippe? And if it dippe, what *inclination* it hath, how deep the loweſt part lies; and conſequently how much deeper than the uppermoſt? As alſo, what it's Flexures, if it have any, are? And whether it runs directly *North* or *South*, *Eaſt* or *Weſt*; or ſeem rather to have a Caſual tendency, than any determinate one by Nature? and how far it reaches in all?

33. What is the Wideneſs of the Groove at the Top, and elſewhere? Whether the Groove be perpendicular or crooked; and if crooked, after what manner, and with what diſtance it winds?

34. How the Groove is ſupported? What are the kinds, length, bigneſs, and way of placing the Timber, Poles, *&c.* that are employed to ſupport it? And how long the Wood will laſt, without being ſpoyled with the ſubterraneous fumes and waters? and what wood laſts longeſt?

35. What Air-ſhaft belongs to the Mine? Whether it be *ſingle*, or more than One? Of what breadth the Air-ſhaft is at the Orifice? Whether it be convenient enough, or not? How neer it is placed to the Groove; and in what poſition? And if there be *ſeveral* Air-ſhafts, what their Diſtances and ſcituation are in reference to the Groove, and to each other? Or how Air is ſupplied, if there be no Air-ſhafts?

36. Whether they meet with any Waters in the Mine? And, if they do, how copious they are; at what depths they occur; how they are qualified; and what way they Spring, *&c.*

37. Whether they are conſtant or temporary? whether they increaſe or diminiſh notably in Summer or Winter, or at any other time of the year; and if they do, at what ſeaſon that is; how long it is wont to laſt; and the proportions of Increaſe and Decreaſe?

38. What Expedients and Engines are employed to free the Mines from Water? The materials, the parts, the bigneſs, the ſhapes, the coaptation; and, in ſhort, the whole ſtructure, number, and way of applying the Inſtruments, that are made uſe off to free the Mines from Water?

39. What are the Conditions, Number, *&c.* of the *Adits?*

40. VVhether the Mine be troubled with *Damps*, and of what kind they are? whether they come often or ſeldom at any ſet time, or altogether irregularly? what Signs fore-run them? what miſchief they do? what remedies are the moſt ſucceſsfully imployed againſt them, aſwell in reference to the Cleering of the Mine, as to the Preſervation and Recovery of the VVork-men?

41. VVhat Methods the Mine-men uſe in following the Vein, and tracing their paſſages under ground (which they call *Plumming* and *Dyalling*) according to the ſeveral exigencies? And whether they employ the Inſtruments, made with the help of the Load-ſtone, the ſame way that is uſual; and if not, wherein they differ in the uſe of the ſame Inſtruments; or what Inſtruments they ſubſtitute in their place?

42. VVhat ways they take to ſecure themſelves from the uncertainty, incident to the guidance of *Magnetick* Needles from the *Iron-Stone* or Ore, that they may meet with under ground?

(of

(of which yet perhaps there is not ſo great danger, as one may imagine; as far as I could find by a Trial, I purpoſely made in a Groove, where I was ſure, there wanted not Iron-Ore.) And what other wayes may be uſed to direct Miners without the help of a Load-ſtone?

43. How the Miners deal with the Rocks and Sparrs, they often meet with, before they come at the Ore? Whether they uſe Fire to ſoften, calcine, or crack them? How they employ it, and with what meaſure of ſucceſs?

44. What wayes and cautions they uſe, to free the Mine and ſecure the Work-men from the inconveniencies and danger accruing from the uſe of much fire in it?

45. What Inſtruments they uſe to break the Rock *&c?* And how thoſe Inſtruments are conducive; and how long they laſt?

46. How the Mine-men work; whether naked or cloathed? And what Lights they uſe to work by; what materials they are made of, what meaſure of light they give; how long they laſt; and by what wayes they are kept burning in that thick and foggy air?

47. How Veins are follow'd, loſt, and recover'd? And how ſeveral Miners work on the ſame Vein? And what is the beſt way of getting all the Ore in a Vein, and moſt conveniently?

48. How they convey out their Ore, and other things, that are to be carried out of the Mine? Whether they do it in Baskets drawn up by Ropes, or upon Mens backs; and if this laſt-named way; what kind of Veſſels they uſe for matter, ſhape, and capacity? And whether the Work-men deliver them one to another; or the ſame Work-men carry them all the way? And whether the Diggers deſcend and aſcend by Ladders of Wood, or of Ropes, *&c.*

About the Fifth Title.

49. Whether the Ore runs in a Vein; or lie diſpers'd in ſcatter'd pieces; or be divided partly into a Vein, and partly into looſe maſſes; or like a Wall between two Rocks, as it were in a Cleft; or be interſpers'd in the firm Rock, like ſpeckled Marble? Or be found in *Grains* like *Sand* or *Gravel*; as ſtore of

of excellent *Tin* is said to be found in some parts of *Cornwall* at the Sides and in the Channels of running Waters, which they call ....., or whether the Ore be of a softer consistence, like *Earth* or *Lome*, as there is Lead-ore in *Ireland* holding store of Silver; and Iron-ore in the North parts of *Scotland* and elsewhere? And what is observable in it as to Weight, Colour, Mixture, *&c*?

50. Whether any part of the Metal be found in the Mine perfect and complete? (As I have had presented me good valuable *Copper*, and pieces of perfect *Lead*, that were taken up, the one at *Jamaica*, and the other by an acquaintance of mine, that took them out of the ground himself in *New England*.)

51. Whether the Mine affords any parcels of Metal, that seem to grow like *Plants* (as I have sometimes seen Silver growing, as it seemed, out of Stone, or *Sparre* almost like blades of Grass; as also great Grains of a Metal, which appear'd to me, and which those, that tryed some of it, affirmed to be Gold, abounding in a stony lump, that seem'd to consist chiefly of a peculiar kind of *Sparre*.)

52. VVhether the Vein lie near, or much beneath the surface of the Earth, and at what depth?

53. VVhether the Vein have or have not any particular Concomitants, or Coats (if I may so call them;) and, if any, what they are, and in what order they lie? (As the Veins of *Lead-ore*, with us, have frequently annnext to them a Substance call'd *Sparre*, and next to that another, call'd *Caulk*.

54. VVhether (besides these Coats) the Vein have belonging to it any other *Heterogeneous* substance? (As in *Tin-mines* we often find that yellow substance, which they call *Mundick*.)

55. VVhat are the principal Qualities of these Extraneous substances? (As that *Sparre* is white, but transparent, almost like course Crystall, heavy, britle, easily divisible into flakes, *&c*. *Caulk* is of a different texture, white, opacous, and like a Stone, but much more ponderous. *Mundick* I have had of a fine golden colour; but, though it be affirm'd to hold no Metal; yet I found it in weight, and otherwise, to differ from *Marchasites*; and the Mine-men think it of a poisonous nature.)

56. Whether the Vein be incloſed every way in its Coats; or whether it only lye between them?

57. Whether the Vein be every way of an uniform breadth, and thickneſs; and, if it be, what theſe Dimenſions are; and, if not, in what places it varies, and in what meaſures? (The like Queſtions are to be made concerning the *Sparre*, *Caulk*, and other Teguments or mixtures of the Ore?)

58. VVhether the Vein be un-interrupted, or in ſome places broken off; and whether it be abruptly, or not; and whether it be by Vales, Brooks, Gullets, *&c.*

59. How wide the Interruptions are? what Signs, whereby to find the Vein again? whether the ulteriour part or diviſion of the Vein be of the ſame Nature, and hold on in the ſame Courſe, as to its tendency upwards or downwards, or Horizontally, Norward, Southward, *&c.* with the Vein, from which it is cut off?

60. VVhether, in caſe the laſt end of the Vein be found, it terminate abruptly, or elſe end in ſome peculiar kind of Rock or Earth, which does, as it were, cloſe or Seal it up, without leaving any crack or cranny, or otherwiſe? And whether the terminating part of the Vein tend upwards, downwards, or neither? And whether in the places, where the Vein is interrupted, there be any peculiar Stone or Earth, that does, as it were, ſeal up the Extremity of it?

61. Whether it be obſerved, that the Ore in Tract of time may be brought to afford any Silver or Gold, which it doth not afford, or more than it would afford, if it were not ſo ripe? And whether it have been found, that the Metalline part of the Vein grows ſo, that ſome part of the Mine will afford Ore or Metal in tract of time, that did not ſo before? And whether to this Maturation of the Mine, the being expoſed to the free Air be neceſſary; or, whether at leaſt it conduce to the Acceleration of it; or otherwiſe?

62. Whether all the Ore, contained in the Mine, be of the ſelf-ſame nature and goodneſs; and, if not, what are the differing kinds; and how to be diſcriminated and eſtimated?

63. VVhat is the fineneſs and goodneſs of the Ore, by which the Mine is wont to be eſtimated? And what are the marks and characters,

characters, that distinguish one sort from another?

64. What proportion of Metal it affords? (As in our *Iron-mines* 'tis observed, that about three Tuns of Iron-stone will afford one Tun of Metal: And I have had *Lead-Ore*, which an Ingenious man, to whom I recommended such Tryals, affirm'd to me to afford three parts in four of good Lead.)

65. Whether the Ore be pure in its kind from other Metals, and, if not, of what Metals it participates; and in what proportion? Which is especially to be inquired into, in case the Mine be of a *base* metal, that holds a *noble* metal. (As I have known it observ'd, that *Lead-Ore*, that is poor in its own metal, affords more Silver, than other; and I remember, that the *Ore* lately mention'd, being rich in Lead, scarce afforded us upon the *Cuppel*, an Atome of Silver. And *Mattheſius* informs us, that a little Gold is not unfrequently found in *Iron-Ore*. And I have by me some Gold, that never endur'd the Fire, taken out of a Lump of Tin-Ore.)

About the sixth Title.

66. What are the mechanick and prævious Operations, as Beating, Grinding, Washing, *&c.* that are used to separate the Ore from the Heterogeneous Bodies, and prepare it for the Fire? Or whether the Ore requires no such preparation? (as it often happens in Lead, and sometimes in Iron, *&c.*)

67. Whether *Mercury* be made use off, to extract the nobler from the baser metals? (as is their practice in *Peru*, and other parts of the *West-Indies.*)

68. Whether the leaving the Ore expos'd to the open Air and Rain for a good while, be used as a Præparative? (as I have seen done in *Iron-stone.*)

69. Whether the Burning and Beating of the Ore be used to prepare it for the Furnace? (as is practised in *Iron*, and almost always in *Copper*:) And, in case they use it more than once, how often they do it; (for, *Copper-Ore* is in some places washed 8. or 10. times, and in others, 12. or 14.) and with what circumstances; as, how long the Ignition lasts at a time, whether the Ore be suffer'd to cool of it self, or be quench'd? whether it be washed betwixt each Ignition?

70. What Flux-powders, and other ways they have to try

and examine the goodneſs of the Ore in ſmall quantities?

71. VVhether, when they work in *great*, they uſe to melt the Ore with any Flux or Additaments, or only by the force of the Fire, or in any way between both? (As throwing in of Charcoals when they melt Iron-ſtone does not only ſerve to feed the Fire, but perhaps by the *Alchaly* of its Aſhes to promote the fuſion: ſo Lime-ſtone, *&c.*)

72. What kind of Furnaces they uſe, to melt the Ore in? Whether they be all of one ſort and bigneſs, or of differing?

73. What are, the Situation, Materials, Dimenſions, Shape, Bigneſs, and in ſhort what is the whole ſtructure and Contrivance of the Furnace? If there be any thing peculiar and remarkable? VVhat Tools are uſed in Smelting, their Figures, uſe, *&c.* And the whole manner of working?

74. VVhat kinds of Fewel, and what quantities of it, are wont to be employed in the Furnace, within the compaſs of a day, or week? How much is put in at a time? How often it is renewed? And how much Ore in a determinate time, as a week or a day, is wont to be reduced to Metal?

75. In caſe an Additament be employed, what that is, and in what proportion it is added? VVhether it be mingled with the Ore, before that be put into the Fire, or caſt in afterwards; and, if ſo, at what time, *&c*?

78. VVhether the Ore be melted by a VVind, excited by the Fire it ſelf; as in VVind-ovens? Ore by the courſe of VVaters? Or acuated by the blaſt of Bellows; and, if ſo, whether theſe Bellows be mov'd by a VVheel, turn'd by VVater running under it, or falling on it? And what are, the Dimenſions, Situation, *&c.* of the Bellows?

79. VVhat contrivance they have, to let or take out the Metal, that is in fuſion; and caſt it into Barrs, Sows, Pigs. *&c*?

80. VVhat Clay, Sand, or Mould they let it run or pour it through? And after what manner they refrigerate it?

81. VVhether or no they do, either to facilitate the fuſion, or to obtain the more or better Metal, mingle differing ſorts or degrees of Ore of the ſame metal? (As in ſome places 'tis uſual, to mingle poor and rich Ore; and at *Mendip* they mix two or more of thoſe differing kinds of *Lead-ore* that they call *Frim-ore*, *Steel-ore*, *Potern-ore*, &c.)

82. Whe-

82. VVhether or no, having once brought the Ore to fusion, they melt all the Metal it self, to have it the more pure? And, if they do, with what circumstances they make the fusion?

83. VVhether they have any Signs, whereby to know whether the Fusion have been well or ill perform'd; and the Metal have obtain'd the perfection, to be expected from such Ore, melted in such a Furnace?

84. VVhether they observe any great difference in the goodness of the Metal, that first melts, from that of the rest of the Metal which comes afterwards in the same or another operation? And whether the Rule holds constantly? (For, though they observe in *Tin-Mines*, the best Metal comes first, yet in the works of an Industrious friend of mine, he informs me, that the best Metal comes last.)

85. Whether the produced Metal be all of the same goodness? And if it be, how good it is in reference to the Metal of other Mines, or other parts of the same Mine or Vein? And if it be not, what differences are observ'd between the produced portions of Metal; and what disparity that amounts to in the price?

86. What are the Wayes of distinguishing them, and estimating their goodness?

87. Whether they do any thing to the Metal, after it is once brought to Fusion, and, if need be, melt it over again, to give it a melioration? (As when *Iron* is refined, and turn'd into Steel;) And what distinct Furnaces, and peculiar Ways of ordering the Metals are employ'd to effect this improvement? With a full description of them and the Tools in all Circumstances, observ'd in the refining of Metals.

88. Whether in those places, where the Metal is melted, there be not elevated some Corpuscles, that stick to the upper parts of the Furnance, or Building? And, if there be, whether they be barely fuliginous and recrementitious exhalations, or, at least in part, Metallin Flowers? (As in the *Cornish* Tin-mines, after some years they usually destroy the thatch'd Houses, where the Ore hath been melted, to get the stuff, that adhears to the insides of the Roofs, out of which they melt store of excellent Tin.)

89. Whether the Metal, being brought to fusion, affords any

any Recrements? (As *Iron-ſtone* affords ſtore of a dark Glaſs or Slagg) And, if it do, what thoſe Recrements are? How they are ſeparated from the Metal; and to what Uſes they are employed?

90. Whether, after the Metal has been once melted, the remaining part of the Ore being expoſed to the Air, will in tract of time be impregnated, or ripen'd, ſo as to afford more Metal? (For, this is affirm'd to me of the *Corniſh* Tin-Ore; and what remained after the fuſion of *Iron-ore* in the *Foreſt of Dean*, is ſo rich in Metal, that a Tenant of mine in *Ireland*, though he had on the Land, he held from me, an Iron-Mine, found it leſs profit to work it, than to ſend croſs the Sea to the *Foreſt of Dean* for this already us'd Ore, which having lain for ſome ages, ſince it was thrown aſide in great heaps expos'd to the Air, he affirm'd to yield as well great great ſtore of Iron, as very good: though I ſomewhat doubt, whether this be *totally* to be aſcribed to the Aire, and length of time; or to the leaving of Metal in the Slaggs in old times, before great Furnaces were in uſe.)

Promiſcuous Inquiries about Mines, from the ſame Author.

1. Whether the Territorie, that bears the Mine, abounds with no other Kind of Mineral in ſome diſtinct part of it? (As in *Kent* near *Tunbridge*, one part of the Country which is Hilly, abounds all along with *Iron-Mines*; the other, which is alſo Hilly, and divided from it but by a ſmall Valley, abounds exceedingly (as the Diggers and Inhabitants told me upon the place) in *Quarry's*, which the Metallin-Country wants, but is quite deſtitute of Iron-ſtone. And ſo at *Mendip*, in one part of the Hill, I ſaw ſtore of *Lead-Mines*, containing ſeveral Kinds of Ore of that Metal; another part of the Hill I found to be full of *Cole-pits*, which had ſome *Marchaſites*, but no Metal; and in another place, *Iron-ore*, and mixt with Ores, which yet they did not think fit to work.)

2. Whether the Air appear to be really cold in Summer, and

and hot in Winter at the bottom of the Mines, by ſurer proofs than the Teſtimony of our Touch?

3. Whether they ever meet with places and Stones actually very hot, as *Mattheſius* relates? And whether that ſpring not from the quenching of *Marchaſites?*

4. Whether they find in the Mines any Mineral Gelly, ſuch as the *German* Naturaliſts call *Ghur?* And whether in proceſs of time it will harden into a metal, or Mineral Concretion?

5. What are the Laws, Conſtitutions, and Cuſtoms, *Oeconomical, Political, Ethical,* that are receiv'd and practis'd among the Mine-men?

6. Whether the Diggers do ever really meet with any ſubterraneous *Dæmons*; and if they do, in what ſhape and manner they appear; what they portend; and what they do, *&c?*

7. Whether they obſerve in the Trees and other Plants, growing over or neer the Mine, not only, (as hath been already intimated) that the Leaves are any whit gilded or ſilver'd by the aſcending Mineral Exhalations, but alſo, that the Trees or other Plants are more ſolid and ponderous? And if they have not alſo ſome diſcernable Metalline or Mineral Concretes, to be met with in the ſmall Cavities and Pores of their ſubſtance?

8. Whether there be not Springs, and alſo greater Streams of Water neer the Mine, that riſe, and run their whole courſe under ground, without ever appearing above it?

9. Whether the Subterraneous Springs do riſe with any wind or determinate change of weather?

10. How much heavier the *Atmoſphere* is at the bottom of the Mine, than at the top? And whether Damps conſiderably increaſe the weight of it?

11. Whether they find any ſtrange ſubſtances in the Mines, as Veſſels, Anchors, Fiſhes inclos'd in Sparr or Metal, *&c.?*

Promiſcuous Inquiries, *chiefly about* Cold, *formerly ſent and recommended to Monſieur* Heuelius; *together with his Anſwer return'd to ſome of them.*

A conſiderable piece of the grand Deſign of the Modern *Experimental* Philoſophers being, to procure and accumulate Materials for a good Natural Hiſtory, whence to raiſe in progreſs of time a ſolid Structure of Philoſophy; all poſſible Endevours are uſed in *England*, to ſend abroad and recommend to as many of Forreign parts, as there is opportunity, *Directions* for ſearching into the Operations of Nature, and for obſerving what occurs therein, aſwell as in Mechanical operations and practiſes.

Several Heads of that kind have been already publiſh'd for this purpoſe in ſeveral of the former Tracts; to which, as we have added, in this, the *Quæries* about *Mines*, ſo we ſhall ſubjoyn thoſe, that were not long ſince committed to the care of that Excellent Promoter of Aſtronomy and Philoſophy, Monſieur *Heuelius*, Conſul of *Dantzick*; who demonſtrates ſo much zeal for the advancement of real knowledge, that he not only improves and promotes it by his own Studies, but labours alſo to incite others to do the like; having already warmed many of the Northern Climate, particularly *Poland*, *Pruſſe*, *Livonia*, *Sweden* and *Denmark*, into a diſpoſition to be ſtudious and active in inquiring after ſuch particulars concerning Philoſophy, as are recommended from hence, and rendred them, very willing to employ themſelves in things of that nature.

The Inquiries ſent to Dantzick, *are theſe*;

1. What Signior *Burattini* (an *Italian* Gentleman, Maſter of the Mint to the King of *Poland*, and reputed a great Maſter in the *Mechanicks*) hath perform'd in *Diopticks*? Whether at preſent he employs himſelf, as is related, in grinding a *Teleſcope* of 120 foot long? And, if ſo, what way he means to make uſe of,

of, commodiouſly to handle a Tube of that length?

2. Whether the ſame have the Art (as has been written from *Paris*) to make ſuch Glaſs, as is not at all inferiour to *Venice*-glaſs, and exceeds any plate of Glaſs, hitherto made there, twice or thrice in bigneſs?

3. What is the way of making Pot-aſhes in *Poland*?

4. What is to be obſerved about *Succinum* or Amber? whether it be an Exſudation of the Sea? whether it be ſeen to float upon the ſurface of the Sea? whether it be ſoft, when 'tis firſt caſt on ſhore? At what ſeaſon of the year, and in what manner 'tis taken up, *&c*?

5. What is to be obſerv'd in the Digging of *Sal Gemmæ* in *Poland*? what is the Depth of the Mines, ſtored with this Salt? what their diſtance from the Sea, *&c*?

6. What truth there is in that Relation concerning Swallows being found in Winter under waters congealed, and reviving, if they be fiſh'd and held to the fire?

7. Whether there be in the *Bodnick Bay* a Whirl-pool, as is related to be in the Sea of *Norway*, which is commonly call'd the *Maal-ſtroom*? And whether there be any Signs, that ſpeak the communication of thoſe Gulphs by ſubterraneous paſſages; as the Jeſuit *Kircher* affirms in his *Mundus Subterraneus* T.1.p.146?

8. To what depth the Cold in thoſe parts peirces the Earth and Water?

9. Whether their Watches go ſlower by the intenſe cold?

10. Whether their Oyls in hard froſts are turn'd into true, that is, hard and britle, Ice?

11. Whether they can freeze there a ſtrong Brine of Bay-Salt; and a ſtrong Decoction of *Sal Gemmæ*, or Soot; or a ſtrong Solution of *Salt* of *Tartar*, or of *Sugar* of *Lead*?

12. Whether they can congeal meer *Blood*, all the ſerous part thereof being ſever'd? Item, *Canary* Wine; the *Lixiviums* of Soap-boylers, and ſuch as are prepared of other Salts; as alſo, the Spirits extracted out of Salts, as Spirit of *Vitriol*, *Nitre*, &c?

13. Whether an intenſe and laſting Froſt makes any alteration in *Quick-ſilver*, expoſed very ſhallow in a flat Veſſel.

14. Whether the Purgative virtue of *Cathartick*s be increaſed or leſſened, or even totally deſtroy'd by a ſtrong and continued Cold?

15. Whether Harts-horn thaw'd, and ſuch like ſubſtances, uſing the ſame method of Diſtilling, yield the ſame quantity of Liquor, which they uſe to yield, when not frozen?

16. What Cold operates in the Fermentation of Liquors?

17. Whether Birds and Wilde Beaſts grow white there in Winter, and recover their native colour in Summer?

18. Whether Colours may be concentred by a ſharp cold? *E. g.* A ſtrong Decoction of Cocheneel in a fit Glaſs?

19. Whether the *Electrical* virtue of *Amber*, and the *Attractive* and *Directive* force of the *Magnet*, be changed by a vehement Cold?

20. Whether pieces of Iron and Steel, even thick ones, be made britle by intenſe froſts; and therefore Smiths are obliged for prevention, to give their Iron and Steel-tools a ſofter temper?

21. Whether accurate Obſervations evince, that all Fiſhes dye in frozen Waters, if the Ice be not broken? Where it is to be diligently inquired into, whether the Cold it ſelf, or the want of changing or ventilating the water, or the privation of Air, be the cauſe of the death of Fiſhes?

22. Whether any Phyſicians or Anatomiſts have inquired, by freezing to death ſome Animals (as Rabits, Pullets, Dogs, Cats, *&c.*) after what manner it is, that Intenſe Cold kills men? whether they have found any Ice in the Inner parts; and if ſo, in which of them; Whether in the Ventricles of the Brain and Heart; and in the greater Veſſels?

Theſe were the Quæries recommended about a Twelve-month ago. Monſieur *Heuelius* in a late Letter of his, accompanied with ſeveral papers from others, returns this Accompt.

THe Inquiries you propoſed to me, I did impart to ſeveral of my Learned friends: But hitherto I have attained an Anſwer but to few particulars. Among the reſt you'l find a Letter of the Learned *Johannes Schefferus*, Profeſſor in the *Swediſh* Univerſity at *Upſall*, wherein he diſcourſes handſomly of ſeveral things, being ready to entertain a Literary Commerce with you about ſuch matters. Touching *Amber*, I am almoſt of the ſame mind with him, that it is a kind of *Foſſil Pitch* or *Bitumen*, ſeeing it is not only found on the Shore of the *Boruſſian* Sea, but alſo digg'd up in ſubterraneous places, ſome *German* miles diſtant from the Sea,

and that not only in Sandy, but alſo in other Hills of firmer Earth; of which I have ſeen my ſelf pretty big pieces. Concerning *Swallows*, I have frequently heard Fiſher-men affirm, that they have here often fiſh'd them out of the Lakes, in the Winter; but I never have ſeen it my ſelf. Whilſt I am writing this, I receive Letters out of *Denmark*, advertiſing me, that thoſe two Learned men, *Thomas* and *Eraſmus Bartholin*, do intend ſhortly to anſwer the ſame *Quæries*. Next Winter, if God vouchſafe me life and health, I purpoſe to make a Journey to *Konigs-berg*, where I hope to learn many things, eſpecially about *Amber*.

Thus far in anſwer to thoſe Inquiries for the preſent.

To this he ſubjoyns other things, no leſs fit to be communicated to the Curious, in theſe words;

The Books you have ſent me over ſea, I have not yet received: I wiſh, they were all tranſlated into Latin; for I have not *Engliſh* enough, to underſtand all particulars perfectly. For the reſt, you have obliged me, by communicating the Obſervations of the laſt *Eclipſe* of the *Sun*, aſwell thoſe made in *England*, as thoſe of *Paris* and *Madrid*. That I may requite you in ſome meaſure, I ſend you my Obſervations both of *that*, and the *Moons* laſt *Eclipſe*. In the *Sun's Eclipſe*, this is chiefly obſervable, That the *Semidiameter* of the *Moon* from the very beginning, to about 5. or 6. digits of the increaſing *Phaſis* was much leſs than the *Rudolphin* Account imports. For it was then almoſt equal to the *Semidiameter* of the *Sun*: but, after the greateſt Obſcuration, when I again contemplated the *Moons Semidiameter*, I found it 8″ or 9″ bigger than that of the *Sun*; ſo that the *Semidiameter* of the *Moon* was not always, during this Eclipſe, conſtant to it ſelf. It will therefore be worth while, to be hereafter more diligent and curious in this particular, and accurately to obſerve in the *Phaſis* of each *Digit* the *Proportion* of the *Semidiameters* of both Luminaries; to the end, that *firſt* it may be made manifeſt, Whether in all the *Eclipſes* of the *Sun*, or in ſome only, that variation happens; *next*, that the Cauſes of ſuch a *Phænomenon* may be diligently inquired into. Of this Variation, the Excellent *Iſmael Bullialdus* hath alſo obſerved ſomething at *Paris*. For he has written to me, That in the ſame Eclipſe the *Semidiam.* of the *Sun* to the *Semid.* of the *Moon* was, as 16′.9″.to 16′.22″; but that in another

Phaſis of *6 digits*, the Semidiameters appear'd equal. Theſe my Obſervations, if you think them worthy, you may communicate to other Mathematicians. The laſt year 1665. *July* 27. (*ſt. n.*) the *Tables* did alſo indicate an Eclipſe of the *Moon*: but though the Sky here was very cleer, yet the Moon was not at all obſcured by the *true ſhadow*, but entred only a little into the *Penumbra*, wherein it continued 50′. The beginning of its touching the *Penumbra* did then almoſt happen, when *Aquila* was elevated 36° 18′; which is an Example worthy to be noted. I have many Obſervations of the *Eclipſes* of former years by me, which I could not yet make publick, by reaſon of the multitude of my buſineſs, which do almoſt over-whelm me. The Eclipſe of the Moon of this Year 1666. *June* 16. (*ſt. n.*) was obſerved from a Hill neer my Garden, to the end, that we might ſee both together the *Suns ſetting*, and the *Moon riſing*. But I was diſappointed of my hopes: For very thick Exhalations, beſieging the *Horizon*, where the Moon was to riſe, unto 2°. 30′, hindred me from ſeeing the *Moon riſe*, in the Article of the *ſetting* of the *Sun*. Wherefore the firſt *Phaſis* of 1. *dig.* 45′. did not appear but in the *Moons Altitude* of 2°. 30′; when the greateſt Obſcuration was already paſt. The *End* fell out hor. 9. 27′. about 128° from the *Zenith* Weſtward.

I am very glad to underſtand, that you have ſo good *Teleſcopes*, as to make ſuch conſiderable Obſervations in *Jupiter* and *Mars*, as you have lately done in *England*. I have no leaſure now, by reaſon of the Obſervations of the Fixt Stars, which I now almoſt conſtantly am employ'd about, to do any thing in the advancing of *Teleſcopes*. I am obliged to finiſh the *Catalogue* of the *Fixt Stars*; having mean while the contentment to find, that many excellent perſons labour about the Improvement of *Optick Glaſſes*. If I could get a good one of thoſe of 60. foot, you mention, at a reaſonable rate, you would oblige me in ſending me one; perhaps may I be ſo happy, as to make likewiſe ſome good diſcovery or other, by the help thereof. In the mean time, let me know, I pray, the Dimenſions of thoſe Glaſſes, and how they are to be managed. The ingenious *Burattini* has not yet finiſht his *Teleſcope*; as ſoon

as

as he hath, I ſhall acquaint you with it. * Before I conclude, I muſt give notice to the Lovers of *Aſtronomy*, that on the 24. of *September* (ſt. n.) of this year, I have obſerv'd that *New Star* in *Pectore Cygni* (which from the year 1662. untill this time hath been almoſt altogether hid) not only with my naked Eye, like a Star of the ſixth or ſeventh Magnitude, but alſo with a very great *Sextant*. It is ſtill in the very ſame place of the Heavens, where it was formerly from *A.* 1601. to almoſt 1662. For, its Diſtance from *Scheat Pegaſi* hath been by me found 35°. 51′. 20″. and from *Marcab*, 43°. 10′. 50″; which Diſtances (as I have found in my *Journal*) are altogether equal to thoſe, which I obſerv'd *A.* 1658. the 1. of *November*. For the Diſtance from *Scheat* at that time was 35°. 51′. 20″. and from *Marcab*, 43°. 10′. 25″: where that former from *Scheat* exactly anſwers to the recent; and that from *Marcab*, 'tis true, differs in a very few *Seconds*, but that diſparity is of no moment, ſince it only proceeded from thence, that this *New Star* is not yet ſo diſtinctly to be ſeen, as at that time, when it was of the *third Magnitude*. It is therefore certain, that it is the ſelf ſame Star, which *Kepler* did firſt ſee *A.* 1601. and continued untill *A.* 1662. But whether in time it will grow bigger and bigger, or be loſt again, time will ſhew. He that will obſerve this Star, muſt take care, leſt he miſtake thoſe three more *Southern* ones, of the *Sixth Magnitude*, and now in a manner ſomewhat brighter (though not extant on the *Globe*) than the *New Star* in *Collo Cygni*. The higheſt of thoſe three, is diſtant from *Scheat Pegaſi* 36°. 25′. 45″; the middlemoſt from the ſame, 37°. 25′. 20″. and the loweſt, 38°. 4′. 30″. Farewell, and aſſure the Moſt Illuſtrious *Royal Society* of my humbleſt Services.

* A Letter, written ſince from *Paris*, advertiſes, that ſome of the Curious there have received one of theſe Glaſſes of *Sr. Buratini*, and do eſteem it to be good without mentioning the Dimenſion of it: which yet is look'd for by the next.

So far Monſieur Heuelius, whoſe accurate Calcul. of the *Solar Eclipſes* Duration, Quantity, *&c.* is intended to be fully repreſented the next Month, ſince it could not be conveniently done this time. The *annexed* Papers follow.

One is from Monſieur *Joh. Schefferus*, to this purpoſe.

1. That he is confident, the *Royal Society* of *England* will do much good for the advancement of uſefull Knowledge. 2.

2. That he conceives *Amber* to be a kind of *Foſſil Pitch*, whoſe Veins lie at the bottom of the Sea; believing that it is hardned in tract of time, and by the motion of the Sea caſt on ſhore: *He adds*, that hitherto it hath been believed, not to be found but in *Boruſſia*; but he aſſures, that it is alſo found in *Sueden*, on the ſhores of the Iſle *Biorkóó*, in the Lake *Melero*, whoſe water is *ſweet*. Of this, *he ſaith*, he hath a fine piece by him, two inches large and thick, preſented him by one, that himſelf with his own hands had gathered it and ſeveral other pieces, on the ſhore of the ſaid Iſland; affirming withall from the mouth of a Shepherd of that place, that it is thrown out by a ſtrong Wind, bearing upon the ſhore.

3. That it is moſt certain, that *Swallows* ſink themſelves towards Autumne into Lakes, no otherwiſe than *Frogs*; and that many have aſſured him of it, who had ſeen them drawn out with a Net togèther with Fiſhes, and put to the fire, and thereby revived.

4. That 'tis alſo very true, that many *Animals* there grow white in Winter, and recover their own Colour in Summer. That himſelf hath ſeen and had *Hares*, which about the beginning of Winter and Spring were half white, and half of their native colour: that in the midſt of winter he never ſaw any but all white. That *Foxes* alſo are white in Winter; and *Squirrels* grayiſh, mixt of dark and white colour.

5. That 'tis known there generally, that *Fiſhes* are killed, by reaſon of the Ice not being broken: but *firſt*, in ponds only or narrow Lakes; *next*, in ſuch Lakes only, where the Ice is pretty thick; for, where 'tis thin, they dye not ſo eaſily. *Laſtly*, that thoſe Fiſhes that lie in ſlimy or clayie ground, dye not ſo ſoon as others. But, *he adds*, that even in great Lakes, when 'tis a very bitter Froſt, Ice is wont to be broken, either by the force of the Waves, or of the Impriſoned Vapors, raiſed by the agitation of the Water, and then burſting out with an impetuoſity; witneſs the noiſe made by the rupture of the Ice through the whole length of ſuch Lakes, which *he affirms* to be not leſs terrible than if many guns went off together. Whereby it falls out, that Fiſhes are ſeldom found dead in great Lakes.

6. That neither Oyle, nor a ſtrong Brine of Bay-Salt, is truly con-

congeal'd into Ice, in thoſe parts, *Viz.* at *Upſall* in *Sueden.*

7. That the Froſt pierces into the Earth, two Cubits or *Swediſh* Ells; and what moiſture is found in it, is white, like Ice: That Waters, if ſtanding, freeze to a greater depth, even to three ſuch Ells or more; but thoſe that have a Current, leſs: That rapid Rivers freeze not at all; nor ever-bubling Springs; and that theſe latter ſeem even to be warmer in Winter, than Summer.

So far this Obſerver; who likewiſe offers his Services in giving an anſwer to the remaining *Queries*, and in entertaining a commerce in ſuch other Philoſophical matters, as he is converſant in.

Another Paper written by Monſieur *Febre*, chief Secretary to Prince *Ratzivil*, contains theſe particulars;

1. That the College of the Learned in *Boruſsia* finds it not ſo eaſie to reſolve all thoſe *Queries* ſent from *England* to M. *Heuelius*: but yet that they will try what may be done upon it.

2. That as for himſelf, he can aſſure from his own Experience concerning the Effects of Cold; *Firſt*, That in the War againſt the *Muſcovites* and *Coſacks*, *A.* 1655. in *January*, in *White Ruſsia*, at the Siege of *Bichow*, 30. Leagues from *Smolensko*, and three from *Moihilo*, near the River *Boriſthenes*, when they had Quarter in a Village call'd *Iskau*, they were ſeized on with ſuch a Froſt, that all their Proviſions of *Spaniſh* Wines or *Peterſimen*, and *Beere*, were in one Night frozen upon the Sleds, notwithſtanding they were cover'd with Straw; in ſo much, that when next morning they would have drawn of thoſe Liquors, they found all dry, and were conſtrain'd to carry them into a Stove, to thaw them; which they could not do in two whole days, and were obliged to break the Veſſels, and put pieces of the Icy Wine into Kettles to thaw them over the Fire, for Drink: That they asked not for a Draught, but a *Morſel* of Wine or Beer: That their Horſes had no better cheer than themſelves, as to matter of Drink; the Pool of the Village being ſo thoroughly frozen, that there was but very little Water left between the Ice and the bottom of the Pool; whereby the poor Beaſts were forced to drink with great reverence, kneeling on their fore-feet to thruſt their heads into the holes, made for them in the Ice, and to ſuck thence ſome drops of Water; and that, if they had not had Snow to eat, there would have dyed a far greater

number

number of them, than there did. Moreover, that he obſerved, that the *Hungarian Wine*, of which they had a Tun, reſiſted the Cold better, than the *Peter Simen*; for it was not ſo much frozen; unleſs it be, that the Butler had more care of that, than the reſt, by tranſporting it ſooner into the Stove, when he found the exceſs of Cold. Again, that one preſenting him in the March with ſome *Aqua-vitæ*, the Scrue of the Flagon, put to his Mouth, ſtuck ſo cloſe to his Lips, that he could not draw it off, without drawing bloud;

In a *third* Paper, I find theſe particulars from the ſame M. *Febre*.

1. That a conſiderable perſon, one Dr. *Becker*, a great Lover of Curious Inquiries, has given him hopes to entertain this Philoſophical Commerce.

2. That he hath ſeen men dye in *Poland* and *Lithuania* both of *Heat* and *Cold*. And *firſt*, that *A.* 1653. in *July*, being with this preſent King of *Poland* in march from *Leopoli* to the Camp of *Glignani*, it was ſo furiouſly hot that day of their march, that it cauſed ſuch an alteration in that Regiment of Foot, which was the Kings Guard, marching moſt of them bare-foot upon Sands, that more than an hundred of them fell down altogether diſabled, whereof a dozen dyed out-right, without any other Sickneſs. *Secondly*, as to the Cold, that the froſt was ſo bitter, that 3 Souldiers dyed of it, *A.* 1665. the 2. of *January*, in paſſing a long Ditch: beſides, that divers perſons loſt ſome of their Lims.

The Succeſs of the Experiment of Transfuſing the Bloud of one Animal into another.

THis Experiment, hitherto look'd upon to be of an almoſt unſurmountable difficulty, hath been of late very ſucceſsfully perform'd not only at *Oxford*, by the directions of that expert Anatomiſt Dr. *Lower*, but alſo in *London*, by order of the *R. Society*, at their publick meeting in *Greſham Colledge*: the Deſcription of the particulars whereof, and the *Method* of Operation, is referred to the next Opportunity.

Errata to be corrected in Number 18.

Pag. 311. line 18. read *marked*. p. 312. l. 35. r. *Sines*. 16. l. penult. *Sines*. p. 113. l. 13. r. *Sines*. p. 316. l. 26. r. *that* for *if*.

London, Printed for *John Crook* neer the *Blew-Anchor* in *Duck-lane*; and *Moſe Pits* at the *White-Hart* in *Little-Britain*.

PHILOSOPHICAL TRANSACTIONS.

Munday December 17. 1666.

The Contents.

The Method observed in Transfuſing the Bloud out of one live Animal into another: *And how this Experiment is like to be improved. Some Conſiderations concerning the ſame. An Accompt of ſome Sanative Waters in* Herefordſhire. *A farther Accompt of the* Vitriolate *Water mention'd* Numb. 18. *together with ſome other particulars touching Waters. Inquiries for* Turky. *An Obſervation about Optick Glaſſes made of Rock-Cryſtal, communicated from* Italy. *A Relation of the Uſe of the Grain of* Kermes *for* Coloration, *from* France. *An Accompt of ſome Books lately publiſht*, vid. 1. *PINAX Rerum Naturalium BRITANNICARUM, continens VEGETABILIA, ANIMALIA & Foſſilia ANGLIÆ, inchoatus*; *Auth.* Chriſtophoro Merret, *M. D.* 2. *PLACITA PHILOSOPHICA* Guarini. 3. *GUSTUS ORGANUM per* Laurentium Bellini *deprehenſum.*

The Method obſerved in *Transfuſing the Bloud out of one Animal into another.*

THis Method was promiſed in the laſt of theſe Papers. It was firſt practiſed by Doctor *Lower* in *Oxford*, and by him communicated to the Honourable *Robert Boyle*, who imparted it to the *Royal Society*, as follows;

Firſt, Take up the *Carotidal* Artery of the Dog or other Animal, whoſe Bloud is to be transfuſed into another of the

ſame or a different kind, and ſeparate it from the Nerve of the *Eight pair*, and lay it bare above an inch. Then make a ſtrong Ligature on the *upper* part of the Artery, not to be untied again: but an inch below, *videl.* towards the Heart, make another Ligature of a *running* knot, which may be looſen'd or faſtned as there ſhall be occaſion. Having made theſe two knots, draw two threds under the Artery between the two Ligatures; and then open the Artery, and put in a Quill, and tie the Artery upon the Quill very faſt by thoſe two threds, and ſtop the Quill with a ſtick. After this, make bare the *Jugular* Vein in the other Dog about an inch and a half long; and at each end make a Ligature with a running knot, and in the ſpace betwixt the two running knots drawn under the Vein two threds, as in the other: then make an Inciſion in the Vein, and put into it two Quills, one into the *deſcendent* part of the Vein, to receive the bloud from the other Dog, and carry it to the Heart; and the other Quill put into the other part of the *Jugular* Vein, which comes from the Head (out of which, the ſecond Dogs own bloud muſt run into Diſhes.) Theſe two Quills being put in and tyed faſt, ſtop them with a ſtick, till there be occaſion to open them.

All things being thus prepar'd, tie the Dogs on their ſides towards one another ſo conveniently, that the Quill may go into each other, (for the Dogs necks cannot be brought ſo near, but that you muſt put two or three ſeveral Quills more into the firſt two, to convey the bloud from one to another.) After that, unſtop the Quill that goes down into the firſt Dog's *Jugular* Vein, and the other Quill coming out of the other Dog's Artery; and by the help of two or three other Quills, put into each other, according as there ſhall be occaſion, inſert them into one another. Then ſlip the running knots, and immediately the bloud runs through the Quills, as through an Artery, very impetuouſly. And immediately, as the bloud runs into the Dog, unſtop the other Quill, coming out of the *upper* part of his *Jugular* Vein (a Ligature being firſt made about his Neck, or elſe his other *Jugular* Vein being compreſs'd by ones Finger;) and let his own bloud run out at the ſame time into Diſhes (yet not conſtantly, but according as you perceive him able to bear it)

till

till the other Dog begin to cry, and faint, and fall into Convulsions, and at last dye by his side.

Then take out both the Quills out of the Dogs *Jugular* Vein, and tye the running knot fast, and cut the Vein asunder, (which you may doe without any harm to the Dog, one *Jugular* Vein being sufficient to convey all the bloud from the Head and upper parts, by reason of a large *Anastomosis*, whereby both the *Jugular* Veins meet about the *Larynx*.) This done, sow up the skin and dis-miss him, and the Dog will leap from the Table and shake himself, and run away, as if nothing ailed him.

And this I have tryed several times, before several in the *Universities*, but never yet upon more than one Dog at a time, for want of leisure, and convenient supplyes of several Dogs at once. But when I return, I doubt not but to give you a fuller account, not only by bleeding several Dogs into one, but several other creatures into one another, as you did propose to me, before you left *Oxford*; which will be very easie to perform; and will afford many pleasant and perhaps not unuseful Experiments.

But because there are many Circumstances necessary to be observ'd in the performing of this experiment, and that you may better direct any one to doe it, without any danger of killing the other Dog, that is to receive the others bloud, I will mention two or three.

First, that you fasten the Dogs at such a convenient distance, that the Vein nor Artery be not stretched; for then, being contracted, they will not admit or convey so much bloud.

Secondly, that you constantly observe the Pulse beyond the Quill in the Dogs *Jugular* Vein (which it acquires from the impulse of the *Arterious* bloud:) For if that fails, then 'tis a sign the Quill is stopt by some congealed bloud, so that you must draw out the *Arterial* Quill from the other, and with a *Probe* open the passage again in both of them, that the bloud may have its free course again. For, this must be expected, when the Dog, that bleeds into the other, hath lost much bloud, his heart will beat very faintly, and then the impulse

of bloud being weaker, it will be apt to congeal the ſooner, ſo that at the latter end of the work you muſt draw out the Quill ofter, and clear the paſſage; if the Dog be faint-hearted, as many are, though ſome ſtout fierce Dogs will bleed freely and uninterruptedly, till they are convuls'd and dye. But to prevent this trouble, and make the experiment certain, you muſt bleed a great Dog into a little one, or a *Maſtive* into a *Curr*, as I once try'd, and the little Dod bled out at leaſt double the quantity of his own bloud, and left the *Maſtive* dead upon the Table, and after he was untyed, he ran away and ſhak'd himſelf, as if he had been only thrown into water. Or elſe you may get three or four ſeveral Dogs prepared in the ſame manner; and when one begins to fail and leave off bleeding, adminiſter another, and I am confident one Dog will receive all their bloud, (and perhaps more) as long as it runs freely, till they are left almoſt dead by turns: provided that you let out the bloud proportionably, as you let it goe into the Dog, that is to live.

Thirdly, I ſuppoſe the Dog that is to bleed out into diſhes will endure it the better, if the Dogs that are to be adminiſtred to ſupply his bloud, be of neer an equal age, and fed alike the day before, that both their blouds may be of a neer ſtrength and temper.

There are many things I have obſerved upon bleeding Dogs to death, which I have ſeen ſince your departure from *Oxford*, whereof I ſhall give you a relation hereafter; in the mean time ſince you were pleaſed to mention it to the *Royal Society*, with a promiſe to give them an account of this experiment, I could not but take the firſt opportunity to clear you from that obligation, &c.

So far this Letter: the preſcriptions whereof having been carefully obſerv'd by thoſe who were imployed to make the Experiment, have hitherto been attended with good ſucceſs; and that not only upon Animals of the ſame *Species* (as two Dogs firſt, and then two Sheep) but alſo upon ſome of very differing *Species* (as a Sheep and a Dog; the former *Emitting*, the other *Receiving*.)

Note only, that in ſtead of a Quill, a ſmall crooked thin Pipe

Pipe of Silver or Brass, so slender that the one end may enter into a Quill, and having at the other end, that is to enter into the Vein and Artery, a small knob, for the better fastening them to it with a thread, will be much fitter than a strait Pipe or Quill, for this Operation: for so they are much more easie to be managed.

'Tis intended, that these tryals shall be prosecuted to the utmost variety the subject will beare: As by exchanging the bloud of Old and Young, Sick and Healthy, Hot and Cold, Fierce and Fearful, Lame and Wild Animals, &c. and that not only of the same, but also of differing kinds. For which end, and to improve this noble Experiment, either for knowledge, or use, or both, some Ingenious men have already proposed considerable tryals and inquiries; of which perhaps an account will be given hereafter. For the present we shall only subjoyn some

Considerations about this kind of Experiments.

1. It may be consider'd in them, that the bloud of the *Emittent* Animal, may after a few minutes of time, by its circulation, mix and run out with that of the *Recipient*. Wherefore to be assured in these Tryals, that all the bloud of the *Recipient* is run out, and none left in him but the adventitious bloud of the *Emittent*, two or three or more Animals (which was also hinted in the *method* above) may be prepared and administred, to bleed them all out into one.

2. It seems not irrational to guess afore hand, that the exchange of bloud will not alter the nature or disposition of the Animals, upon which it shall be practised; though it may be thought worth while for satisfaction and certainty, to determine that point by Experiments. The case of exchanging the bloud of Animals seems not like that of *Grafting*, where the *Cyons* turns the Sap of the *Stock*, grafted upon, into its nature; the *Fibres* of the Cyons so straining the juice, which passes from the stem to it, as thereby to change it into that of the Cyons, whereas in this transfusion there seems to be no such

Per-

Percolation of the bloud of Animals, whereby that of the one ſhould be changed into the nature of the other.

3. The moſt probable uſe of this Experiment may be conjectured to be, that one Animal may live with the bloud of another; and conſequently, that thoſe Animals, that want bloud, or have corrupt bloud, may be ſupplyed from others with a ſufficient quantity, and of ſuch as is good, provided the Transfuſion be often repeated, by reaſon of the quick expence that is made of the bloud.

Note.

In the laſt Tranſactions *was alſo promiſed an Accompt by the next, of Monſieur* Hevelius *his accurate Calcul. of the late* Solar Eclipſes, *Duration, Quantity, &c. But this being to be accompanyed with a* Scheme, *the* Graving *whereof met with a diſappointment, it muſt be ſtill referred to another Opportunity.*

An account of ſome Sanative Waters in Herefordſhire.

This account was communicated by Dr. *B.* in theſe words.

There are two Springs in *Herefordſhire*, whereof one is within a Bolt, or at leaſt Bow-ſhoot of the top of the near adjoyning lofty Hill of *Malvern*, and at great diſtance from the Foot of the Hill; and hath had a long and old fame for healing of eyes. When I was for ſome years moleſted with Teters on the back of one and ſometimes of both my hands, notwithſtanding all indeavours of my very friendly and skilful Phyſitians, I had ſpeedy healing from a neighbouring Spring of far leſs fame. Yet this Spring healed very old and Ulcerous ſores on the Legs of a poor Fellow, which had been poyſon'd by Irons in the Gaol, after other Chirurgery had been hopeleſs. And by many tryals upon my hands, and the Tetters, I was perſwaded, that in long droughts, and laſting dry Froſts, thoſe waters were more effectually and more ſpeedily healing, than at other times. And not to omit this circumſtance, I did hold this water in my mouth till it was warm, and perchance ſomewhat intermingled with faſting Spittle,

and

and ſo dropping it upon the Teter, I there could ſee it immediately gather a very thin skin upon the raw fleſh, not unlike that which is ſeen to gather upon Milk over a gentle fire. This skin would have ſmall holes in it, through which a moiſture did iſſue in ſmall drops, which being wip'd away, and the water continued to be dropp'd warm out of the mouth, the holes would diminiſh, and at laſt be all quite healed up.

For the *Eye-waters*, I conceived them more ſtrongly terſive, and clearing the Eyes; and they had a rough ſmartneſs, as if they carryed Sand or Gravel into the Eye.

I have known and try'd three or four healing Fountains of *late* diſcovery, or of no old fame that I could hear of.

I did once put rich *Pearl* for ſome days in a veſſel of water, to try whether the water would acquire a healing vertue; but my Experiments were interrupted. I had in my thoughts many other ways of Tryal; which I may reſume hereafter.

A farther Accompt of the Vitriolate-water, *mention'd* Num. 18 p. 323. *Together with ſome other Particulars touching Waters.*

This comes from the ſame hand as follows;

I formerly mention'd to you, that, if that Pool of Mr. *Philip's*, which ſeems to be of Vitriolate-water, were on my ground, I would drain it, and ſearch the head of the Spring, purſuing the ſource, till I could well diſcern, through what lay of Earth or Gravel it does paſs. Now I ſhall tell you, that I have taken order for the further tryal of the ſaid Water, by boiling a greater quantity in a Furnace, *&c.* But juſt as we were in readineſs for the tryal, a ſtream of Rain-water fell into the Pool, and ſo diſcourag'd us for the preſent. I have alſo taken a courſe to turn the falling Waters aſide, and to drain the Pool, that we may ſee, what the Native Springs (whether one or more) may be. Of which more hereafter.

I wiſh (*ſo he goes on*) we had a full Accompt of our *Salt-Springs* at *Droyt-wych* near *Worceſter*, and at *Nant-wych* in *Cheſhire* (what other Salt-Springs we have in *England*, I know not;)

It

It ſhould be inquired, at what diſtance they are from the Seas, or from Salt-fluxes, from Hills, and how deep in the Vales? What the weight? Whether in droughts or long Froſts the proportion of Salt or weight increaſeth? Whether the Earth near the Springs, or in their paſſage hath any peculiar ferment, or produceth a blackiſhneſs, if it reſts, after it is well drained.

Inquiries for Turky.

Though many Relations and Deſcriptions of *Turky* be extant in Print, yet they leave in many a deſire of fuller information in the following particulars, lately drawn up, for the moſt part by Mr. *H.* and recommended to an Ingenious Gentleman, bound for that Country; and deſired alſo to be taken notice off by others, that may have occaſion to viſit the ſame.

1. In what part of *Turky* the * *Ruſma* is to be found; and in what quantity? Whether the *Turks* employ it to any other Uſes, beſides that of the taking away of Hair? Whether there be differing kinds of it? How it is uſed to take off hair, and how to get ſtore of it.

* *Ruſma* is a kind of Earth, uſed in *Turky* to take away hair.

2. Whether the *Turks* do not only take *Opium* themſelves for ſtrength and courage, but alſo give it to their Horſes, Camels and Dromedaries, for the ſame purpoſe, when they find them tired and faint in their travelling? What is the greateſt *Doſe*, any men are known to have taken of *Opium?* and how prepared?

3. What effects are obſerved from their uſe, not only of *Opium* (already mention'd) but alſo of Coffee, Bathing, ſhaving their Heads, uſing Rice; and why they prefer that which grows not unleſs water'd, before Wheat, *&c.*

4. How their Damaſco-ſteel is made and temper'd?

5. What is their way of dreſſing and making Leather, which though thin and ſupple, will hold out water?

6. What method they obſerve in breeding thoſe excellent Horſes, they are ſo much famed for?

7. Whether they be ſo skilful in Poyſoning, as is ſaid; and how their Poyſons are curable?

8. How

8. How the *Armenians* keep Meat freſh and ſweet ſo long, as 'tis ſaid they do?

9. What Arts or Trades they have worth Learning?

10. Whether there be ſuch a Tree about *Damaſcus*, call'd *Mouſlac*, which every year about the Month of *December* is cut down cloſe by the root, and within four or five Months time ſhoots up again apace, bringing forth Leaves, Flowers, and Fruit alſo, and bearing but one Apple (an excellent Fruit) at once?

11. Whether about *Reame* in the Southern part of *Arabia Felix*, there be Grapes without any grains? And whether the people in that Country live, many of them, to a hundred and twenty years, in good health?

12. Whether in *Candia* there be no poyſonous Creatures; and whether thoſe Serpents, that are there, are without poyſon?

13. Whether all Fruits, Herbs, Earth, Fountains, are naturally ſaltiſh in the Iſle of *Cyprus*? And whether thoſe parts of this Iſle, which abound in *Cyprus-trees*, are more or leſs healthful, than others?

14. What ſtore of *Amianthus* there is in *Cyprus*; and how they work it?

15. Whether *Mummies* be found in the ſands of *Arabia*, that are the dryed fleſh of men buried in thoſe ſandy Deſerts intravelling? And how they differ in their vertue from the Embalmed ones?

16. Whether the parts about the City of *Conſtantinople* or *Aſia Minor*, be as ſubject to Earth-quakes now, as they have been formerly? And whether the Eaſtern winds do not Plague the ſaid City with Miſts, and cauſe that inconſtancy of Weather, it is ſaid to be ſubject to?

17. Whether the Earth-quakes in *Zant* and *Cephalonia* be ſo frequent, as now and then to happen nine or ten times a Month? And whether theſe Iſles be not very Cavernous?

18. What is the height of Mount *Caucaſus*, its poſition, temper in its ſeveral parts, *&c*?

19. With what declivity the Water runs out of the *Euxine-Sea* into the *Propontis*? With what depth? And if the many Tides and Eddies, ſo famous by the name of the *Euripi*, have any certain Period?

20. If

20. If in the *Euxin-Sea* there can be found any ſign of the *Caſpian-Seas* emptying it ſelf into it by a paſſage under ground? If there be any different Colour, or Temper as to Heat or Cold; or any great Current or Motion in the Water, that may give light to it?

21. By what Inland paſſages they go to *China*; there being now a paſſage for *Caravans* throughout thoſe places, that would formerly admit of no Correſpondence by reaſon of the Barbariſme of the Inhabitants?

22. Whether in the Aquæducts, theymake, they line the inſide with as good Plaiſter, as the Ancients did? and how theirs is made?

23. To inquire after theſe excellent Works of Antiquity, of which that Country is full, and which by the ignorant are not thought worth notice or preſervation? And particularly, what is the bigneſs and ſtructure of the Aquæducts, made in ſeveral places about *Conſtantinople* by *Solyman* the Magnifiſcent? *&c.*

An Obſervation of Optick Glaſſes, made of Rock-Cryſtal.

This is contained in a Letter, of *Euſtachio Divini*, Printed in *Italian* at *Rome*, as the 39. *Journal des Scavans* extracts it; *vid.*

Though it be commonly believed, that *Rock-Cryſtal* is not fit for Optick-Glaſſes, becauſe there are many Veins in it; yet *Euſtachio Divini* made one of it, which *he ſaith* proved an excellent one, though full of Veins. *

*It may be queried whether thoſe were true Veins, or only Superficial Strictures, and ſlight ſcratches.

An accompt of the Uſe of the Grain of Kermes *for Coloration.*

This was communicated by the Ingenious Dr. *Croon*, as he received it from one, Monſieur *Verny*, a *French* Apothecary at *Montpelier*; who having deſcribed the Grain of *Kermes*, to be an excreſcence, growing upon the Wood, and often upon the leaves

leaves of a Shrub, plentiful in *Languedock*, and gather'd in the end of *May*, and the beginning of *June*, full of a red Juyce; ſubjoynes two Uſes, which that Grain hath, the one for *Medicine*, the other for *Dying of Wool*. Waving the *firſt*, notice ſhall only be taken here of the *latter*, vid. That, for *Dying*, they take the Grain of *Kermes*, when ripe, and ſpread it upon Linnen: And at firſt, whilſt it abounds moſt in moiſture, 'tis turn'd twice or thrice a day, to prevent its Heating. And when there appears red powder amongſt it, they ſeparate it, paſſing it through a Searce; and then again ſpread abroad the Grain upon Linnen, untill there be perceived the ſame redneſs of the powder; and at the end, this red powder appears *about* and *on* the ſurface of the Grain, which is ſtill to be paſs'd through a Searce, till it render no more.

And in the beginning, when the ſmall red Grains are ſeen to move (as they will do) they are ſprinkled over with ſtrong Vinegar, and rubb'd between on's hands: afterwards, little Balls are form'd thereof, which are expos'd to the Sun to dry.

If this red powder ſhould be let alone, without pouring Vinegar or ſome other accid liquor upon it, out of every Grain thereof would be form'd a little Fly, which would skip and fly up and down for a day or two, and at laſt changing its colour, fall down quite dead, deprived of all the bitterneſs, the Grains, whence they are generated, had before.

The Grain being altogether emptyed of its pulp or red powder, 'tis waſh'd in Wine, and then expos'd to the Sun. Being well dryed, 'tis rubb'd in a Sack to render it bright; and then 'tis put up in ſmall Sacks, putting in the midſt, according to the quantity, the Grain has afforded, 10. or 12. pounds (for a *Quintal*) of the duſt, which is the red powder, that came out of it. And accordingly, as the Grain affords more or leſs of the ſaid powder, Dyers buy more or leſs of it.

'Tis to be noted, That the firſt red powder, which appears, iſſues out of the Hole of the Grain, that is on the ſide, where the Grain adhered to the Plant. And that, which about the end appears ſticking on the Grain, hath been alive in the husk, having pierced its cover; though the hole, whence it commonly iſſues, remains cloſe as to the Eye.

An Account of ſome Books lately publiſhed.

I. *PINAX Rerum Naturalium BRITTANIARUM continens VEGETABILIA, ANIMALIA & FOSSILIA, in hoc inſula reperta, Inchoatus, Auth.* Chriſtophoro Merret, *Med. D. & utriuſque* Societatis Regiæ *ſocio.*

The Learned and Inquiſitive Author of this Book, hath by his laudable example of collecting together, what Natural things are to be found here in *England*, of all ſorts (which he has done upon his own expences) given an invitation to the curious in all parts of the world to attempt the like, thereby to eſtabliſh the much deſired and highly uſeful commerce among *Naturaliſts*, and to contribute every where to the compoſing of a genuin and full *Hiſtory of Nature.*

In the *Preface* he intimates, that his ſtock does ſtill encreaſe dayly; and that therefore the Reader may expect an *Appendix* to this collection.

In the Body of the Book, he enumerates all the *Species*, Alphabetically: And, as to *Vegetables*, he reckons up about 410. ſorts; and gives their *Latine* and *Engliſh* Names, and the *Places* and *Times* of their growth: reducing them afterwards to certain *Claſſes*, hitherto uſed by *Botanick* Writers in their *Hiſtories* of *Plants*: Adding the *Etymology* of their Generick Names, and a compendious *Regiſter* of the Time, *when* and *how long* the *Engliſh* Plants do ſhoot and flouriſh.

As to *Animals*, he finds of them about 340. kinds in *England*, whereof the *four-footed* are about 50. *Birds* 170. and *Fiſhes* 120. *Inſects* are innumerable, which yet he endeavours to enumerate, and to reduce to certain *Claſſes*; into which he alſo brings the three former kinds.

Concerning *Foſſils*, he *firſt* takes notice of the *Metals* found in *Engliſh* Mines; as *Silver*, *Tin*, *Copper*, *Iron*, *Lead*, *Antimony*, and ſome *Gold* extracted out of *Tin*. Next of the *Stones*, of which he finds about 70 ſorts; & amongſt them, *Briſtol-Diamonds*, *Agates*, *Hyacinths*, *Emerods*, *Load-ſtones*, *Toad-ſtones* (which laſt yet he affirms to be nothing but the grinding-teeth of the Fiſh

Fish *Lupus*) *Pearls*, *Corals*, *Marble*, *Alablaſter*, *Emery*: To which he adds the various kinds of *Coals*; as alſo *Bitumens*, *Turfs*, and *Jets*. And *thirdly* of the various kinds of *Allum*, *Vitriol*, *Niter*, *Sea-ſalt*, *Pit-ſalt*. But *fourthly* of the various *Earths*, of which he reckons up 15. peculiar ſorts (beſides thoſe that ſerve for *Husbandry*, which are not eaſily numbred;) and amongſt them *Read-lead*, *Black-lead* and *Fullers-earth*.

He concludes all with mentioning the ſeveral *Meteors* appearing in *England*; and the *Hot Springs*, and *Medical Waters*; as alſo, the *Salin*, *Petrifying*, and ſome more unuſual Springs: *Item*, *Subterraneous Trees*, *Subterraneous Rivers*, *Ebbings and Flowings of Wells*, *&c.*

II. PLACITA PHILOSOPHICA Guarini. The chief ſubject of this Treatiſe is Natural *Philoſophy*; upon many important queſtions whereof it inlargeth, as thoſe of the Motion of the Celeſtial Bodies, of Light, of Meteors, and of the vital and animal functions; leaving ſometimes the common opinions, and delighting in the defence of *Paradoxes*.

E.G. That the material ſubſtantial Form, is nothing but *mera potentia*, and ſubſiſts not by it ſelf: by which means the Author judges, he can free himſelf from many great difficulties touching *Generation* and *Corruption*, which do perplex the other Philoſophers.

He holds *Epicycles* to be impoſſible, and *Excentricks*, not ſufficient to explicate the motion of the Stars; but that all the irregularities of this motion may be ſalved by the means of certain *Spiral* Lines; largely proving this *Hypotheſis*, and particularly explicating the motion of each Planet.

He denies the middle Region of the Air to be cold; and believes that cold is not neceſſary to condenſe the vapours into Water.

He admits not that received Axiome, *That the generation of one Body is the corruption of another*; maintaining that there are *Generations*, to which no corruption ever preceeded; and that it may happen, that one Animal without dying may be changed into another Animal.

He alledges ſeveral reaſons to evince, that the Air breathed in, enters not only into the whole capacity of the Cheſt, but alſo into the lower belly.

He

He is of opinion, that the Air, which is commonly believed to corrupt eaſily, is incorruptible; alledging among other reaſons, this for one, that experience ſhews, that if a Botle be exactly ſtop'd, there is never any mixt Body form'd in it; wherefore, *ſaith he*, the Air is not corrupted there.

He maintains, that 'tis not the *Magnet* that draws the Iron, but rather the Iron that attracts the *Magnet*. To explain which he affirms, that the Load-ſtone ſpreads abroad out of it ſelf many corpuſcles, which the ſubſtance of the Iron imbibes; and that, as dry things attract thoſe that are moiſt, by the ſame reaſon Iron draws the Load-ſtone.

He rejects the *ſpecies Intentionales*, *Vital* and *Animal* Spirits, and holds many other uncommon opinions, touching *Light*, the *Iris*, the *Flux and Re-flux of the Sea*, *&c.*

III. GUSTUS ORGANUM per Laurentium Bellini *noviſſimè deprehenſum.*

This Author propoſing to himſelf to diſcover both the principal *Organ* of the *Taſte*, and the nature of its *object*, begins with the latter, and examines firſt, what is *Taſte*? He judges that it is cauſed by nothing but Salts, which being variouſly figured, affects the tongue variouſly: alledging this for his chief reaſon, that the Salt which is extracted by *Chymiſts* out of any mixt body whateuer it be, carries away with it all its taſte, and that the reſt remains taſte-leſs. He adds that the Teeth in grinding the Food, ſerve much to extract this Salt: And he notes by the by, that the Teeth are ſo neceſſary for preparing the aliment, that certain Animals which ſeem to have none, have them in their ſtomach; and that nature has put at the entry of the palat of thoſe that are altogether deſtitute of them, certain moveable inequalities, which are to them inſtead of Teeth.

But then *ſecondly*, concerning the *Organ* of Taſte, he eſteems, that 'tis neither the Fleſh, nor the Tongue, nor the Membrans, nor the Nerves found there, nor the Glanduls, called *Amygdalinæ*; but thoſe *little eminences*, that are found upon the tongue of all Animals. To obtain which, he obſerves,

1. That from the middle of the Tongue to the root, as alſo towards the tip, there are found innumerable *little Riſings* called

led *Papillares*; but that from the tip of the Tongue unto the ſtring there is obſerved none at all.

2. He hath experimented, that if you put *Sal Armoniack* upon the places of the Tongue, where thoſe *Eminencies* are not, you ſhall find no Taſte; but that you will find it preſently, aſſoon you put any ſuch Salt, where they are to be met with. Ergo, *ſaith he*, thoſe *Eminencies* are the principal Organ of Taſte.

3. He aſſures, that with a *Microſcope* may be ſeen in thoſe *Riſings* many little holes, at the bottom whereof there are ſmall nerves, terminating there: But *he directs*, to obſerve this in live and healthy, not in dead or ſick Animals.

Having laid down theſe Obſervations, he concludes, that the manner, after which Taſte is perform'd, is this, That the particles of Salt paſſing through thoſe pores, which pierce the *Papillary Eminences*, and penetrating as far as to the nerves, that meet them there, do by the means of their ſmall points prick them; which pricking is called the *Taſte*.

In the mean time he acknowledges, that before him Signior *Malpighi*, Profeſſor at *Meſſina*, had made ſome of theſe diſcoveries.

The notice of theſe two laſt Books we owe to the *French Journal*.

Correct in Numb. 19.
Pag. 342. lin. 33. read *mixt Ores* inſtead of, *mixt with Ores*.

Correct in this preſent Numb. 20.
Page 359. line 13. Read *Marle* for *Pearle*.

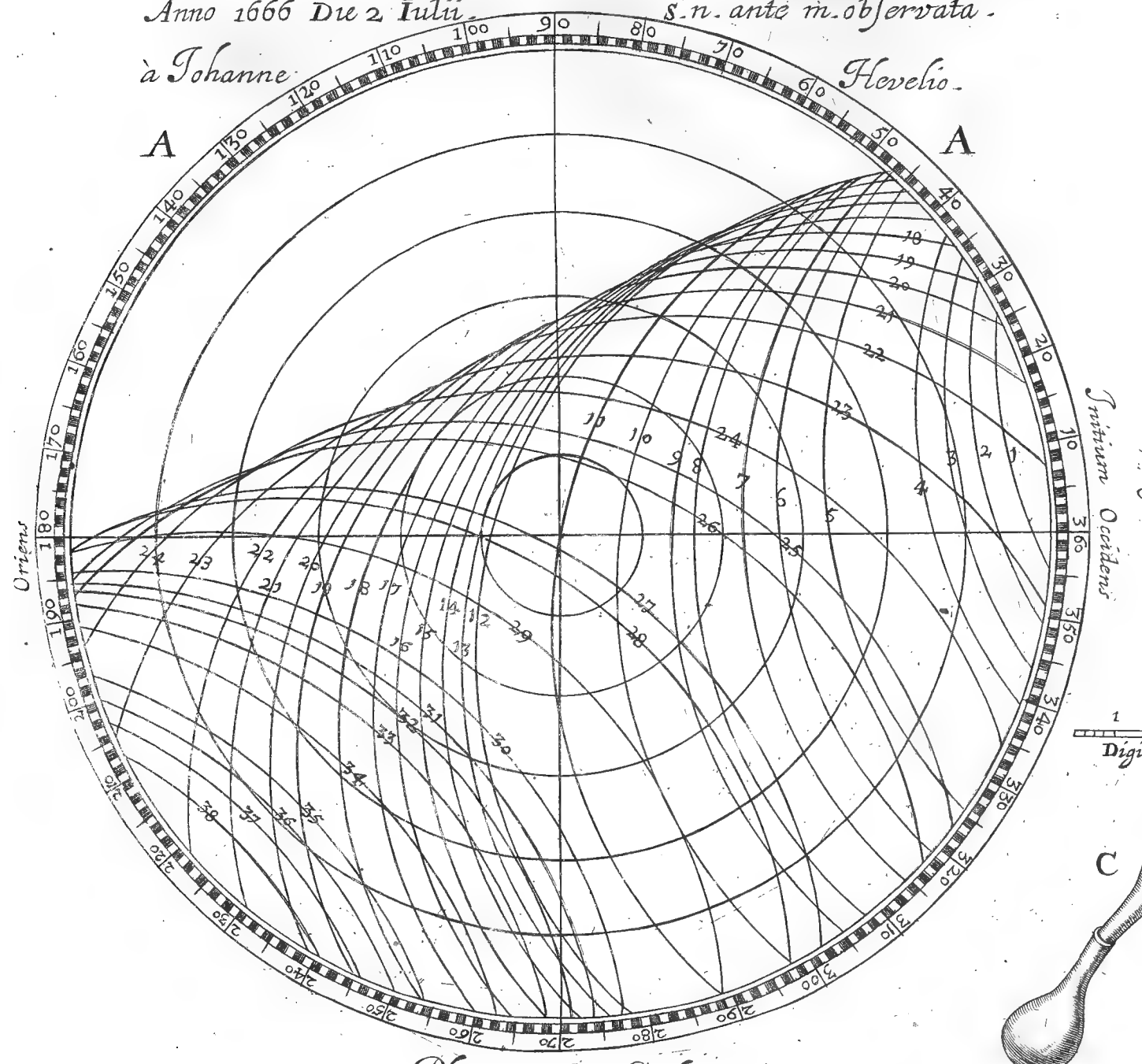
London, Printed for *Moſes Pitt* at the *White-Hart* in *Little-Britain*.

N.° 21

Eclipsis Solaris GEDANI.

Anno 1666 Die 2 Iulii. s.n. ante m. observata.

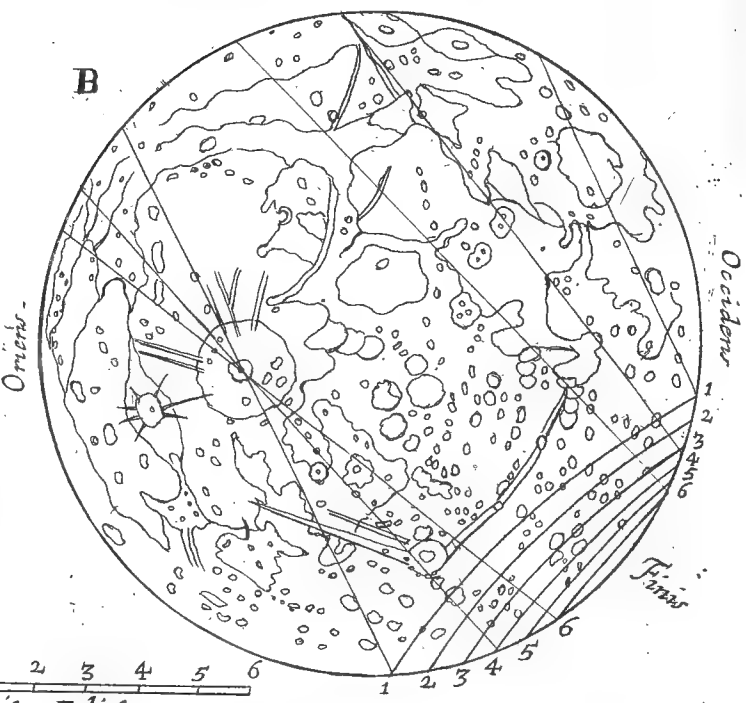
à Johanne Hevelio.

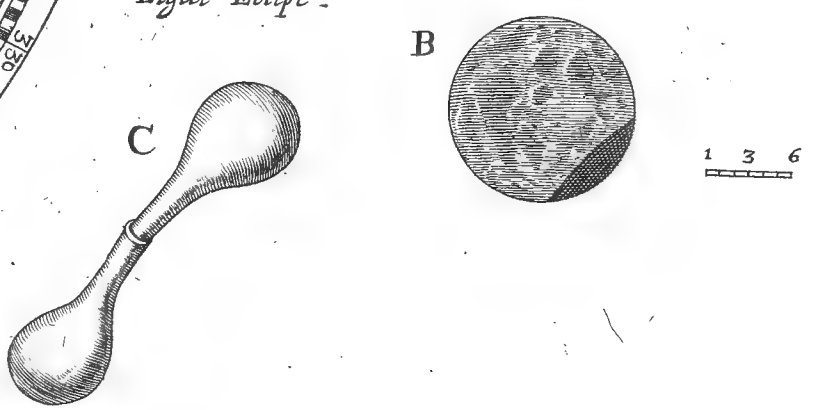


Eclipsis Lunæ obseruata GEDANI,

Anno 1666. Die ☿ 16 Iunii. St. n.

à Johanne Hevelio.





Occidens

PHILOSOPHICAL TRANSACTIONS.

Munday, January 21. 1666.

The Contents.

An Account, formerly promiſed, of Monſieur Hevelius's *Calculation of the late* Solar Eclipſe's *Quantity, Duration, &c. The Figure of the Star in the Conſtellation of* Cygnus, *together with the New Star in it, diſcovered ſome years ago, and very lately ſeen again by the ſame Mr.* Hevelius. *An Extract of a Letter, written by Mr.* Auzout, *concerning a way of his, for taking the* Diameters *of the Planets, and for knowing the* Parallax *of the* Moon: *Giving alſo a Reaſon, why in the* Solar Eclipſe *above-mentioned, the* Diameter *of the* Moon *did increaſe about the end. A Relation of the loſs of the Way to prepare the* Bononian Stone *for ſhining. A Deſcription of a* Swediſh Stone, *affording* Sulphur, Vitriol, Allum, *and* Minium. *A Relation of the Raining of Aſhes. An Extract of a Letter from* Rome, *rectifying the Relation of* Salamanders *living in Fire. An Account of ſeveral Engagements for* Obſerving of Tydes. *Some Suggeſtions for Remedies againſt Cold. A Relation of an uncommon Accident in two Aged Perſons. An Account of Two Books,* I. ISMAELIS BULLIALDI ad Aſtronomos Monita duo: Primum, de Stella Nova, in *Collo Ceti* ante aliquot annos viſa. Alterum, de Nebuloſa Stella in *Andromedæ* Cinguli parte *Borea,* ante biennium iterum ortâ. II. ENTRETIENS ſur les vies & ſur les Ouvrages des plus excellens Peintres, antients & modernes, par M. FELIBIEN.

Monſieur *Hevelius*'s Calculation of the late *Solar Eclipſe's* Quantity, Duration, *&c.*

THis *Calculus* was not long ſince communicated by Monſieur *Hevelius* in a Letter to the *Publiſher,* as follows,

Eclipſis Solaris.

Obſervata An. 1666. D. 2. Julii, St. N. Mane, à Johanne Hevelio.

Ordo Phaſium	Quantitas Phaſium.	Temp. æſtim. ſec. horol. ambulat.	Temp. ex Sciother.	Altitud. ☉	Tempus correct.	*Animadvertenda.*
		H. ′ ″	H. ′ ″	°. ′	H. ′ ″	
		5.51.11	5.51. 0	17.45	5.53.12	Quòd Sciatericum cum correcto tempore non omninò convenit, non-niſi Lineæ Meridianæ imputandum.
		5.57. 5	5.57. 0	18.37	5.59.28	
		6. 0. 0	6. 0. 0	18.55	6. 1.28	
	Initium.	6.55.30			6.57.30	Initium circa 79 gr: à puncto *Zenith* occaſum verùs contigit.
1	0 3/8 dig.	6.57.30			5.59.30	
2	0 3/4	7 0.23	7. 0. 0		7. 2.23	
3	1 1/8	7. 2.30	7. 2. 0		7. 4.30	
4	1 1/2 dig.	7. 4.50	7. 5 ferè.		7. 6.50	
5	1 3/8 ferè.	7.10.57	7.10		7.12.57	
6	3 3/8	7.14.59	7.15		7.16.59	
7	3 3/4	7.17.50	7.18 ferè.		7.19.50	
8	4 3/8 dig.	7.21.35	7.21		7.23.35	
9	4 2/3	7.23.43	7.23 ferè.		7.25.43	
10	5 1/4	7.27.53	7.28		7.29.53	Hujuſque Semidiameter Lunæ æqualis extitit Solari.
11	6	7.31.50	7.32		7.33.50	
12	6 3/4	7.36.55	7.37		7.38.55	
13	6 7/8 paul. plus.	7.38. 5	7.38		7.40. 0	
14	7 1/8	7.39.45	7.39		7.41.45	
15	7 1/4 paul. plus.	7.42.30	7.42		7.44.30	
16	7 1/2	7.44. 6	7.44		7.46 6	
17	7 2/3	7.46. 0	7.46		7.48. 0	
18	8 ferè.	7.48.25	7.48 ferè.		7.50.25	
19	8 1/5	7.51.15	7.51		7.53.15	
20	8 1/4 paul. plus.	7.53.37	7.52		7.55.37	
21	8 3/4	7.55.45	7.56 ferè.		7.57.45	
22	8 3/4 paul. min.	7.59. 5	7.59		8. 1 5	Maxima diſcurrentio extitit [illegible]
23	8 1/5	8. 6.30	8. 6		8. 8.30	

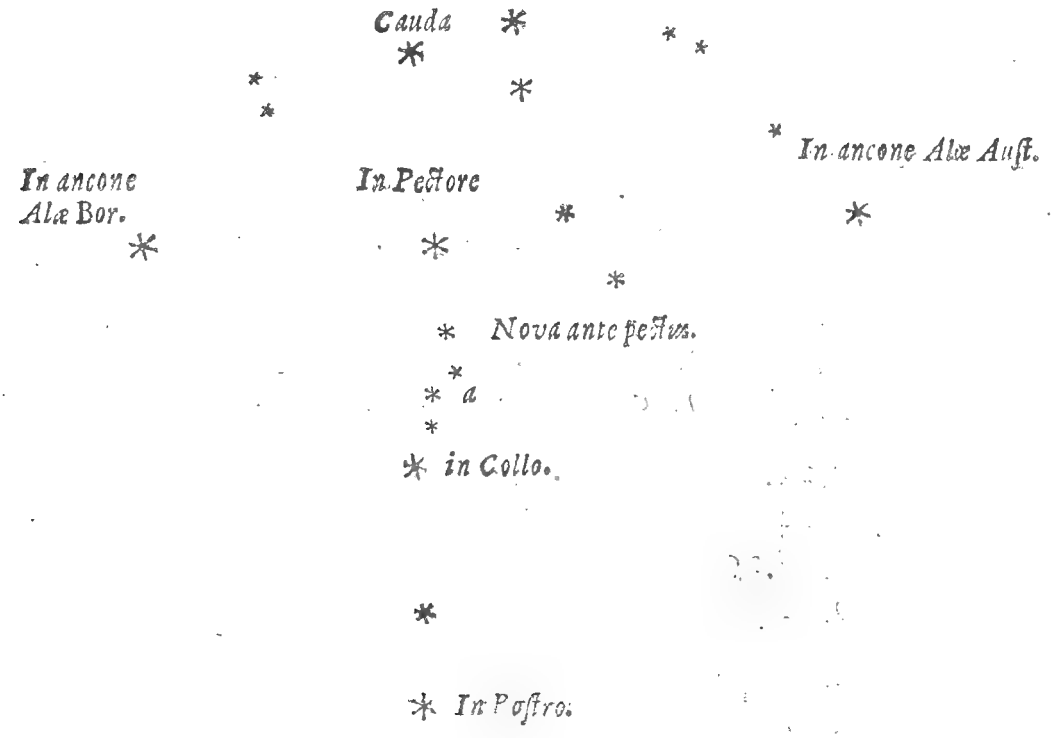
Ordo

Ordo Phaſium	Quantitas Phaſium.	Temp. æſtim. ſec. horol. ambulat.	Temp. ex Sciother.	Altitud. ⊙	Tempus correct.	*Animadvertenda.*
		H. ′ ″	H. ′	o.	H. ′ ″	
24	7 $\frac{3}{4}$	8.11.25	8.12		8.13.25	Hic Semidiameter *Lunæ* ad 8ª vel 9ª major apparuit. *
25	7 $\frac{1}{4}$ ferè.	8.17.30	8.18		8.19.30	* *See Numb.* 19. *of the Philoſophical Tranſactions*, p. 347.
26	7 fere.	8.19.41	8.19		8.21.41	
27	5 $\frac{7}{8}$	8.28. 8	8.28		8.30. 8	
28	5 $\frac{1}{2}$ fere.	8 30 14	8.30		8.32.14	
29	4 $\frac{3}{4}$	8 36 25	8.36		8.38.25	
30	3 $\frac{5}{8}$	8 43 19	8.43		8.45.19	
31	3 $\frac{1}{4}$	8 46 12	8.46 ferè.		8.48.12	
32	3	8.47.32	8.47		8.29.32	
33	2 $\frac{3}{4}$	8.50.57	8.50		8 .2.57	
34	2 $\frac{1}{2}$ fere.	8.54.15	8.54		8.56.15	
35	1 $\frac{3}{8}$	8.58.24	8.58		9. 0.24	
36	1 $\frac{1}{8}$	8.59.35	8.59		9. 1.35	
37	0 $\frac{5}{6}$	9. 1.38	9. 1		9. 3.38	
38	0 $\frac{1}{2}$	9. 3.20	9. 3		9. 5.20	
39	*Finis.*	9. 6.53	9. 6	Altit. ⊙	9. 8.53	Punctum finis diſtitit à verticali ad Ortum 143 gr.
		9.23. 6		47.33	9.25.28	
		9.24.16		47.42	9.26.45	
		9.28.29		48.10	9.30.42	
		9.30.36		48.28	9.33.12	

This Obſervation is by the ſame *Aſtronomer*, repreſented alſo by the *Figures AAAAAA*; as that of the *Horizontal Eclipſe* of the *Moon*, is, by the *Figures BB*.

The Figure of the Stars in the Conſtellation of Cygnus; *together with the* New Star *in it, diſcover'd ſome years ſince, and very lately ſeen by M.* Hevelius *again.*

THe Relation concerning this *New Star* in the *Breſt of Cygnus*, very lately diſcover'd again at *Dantzick*, by M. *Hevelius*, was publiſh't *Numb.* 19. *p.* 349. The *Figure* of that *Conſtellation*, with the *New Star* in it, was thus, haſtily drawn, ſent over by that Obſerver.



An

An Extract

Of a Letter written Decemb. 28. 1666. *by M.* Auzout *to the Publiſher, concerning away of his, for taking the* Diameters *of the* Planets, *and for knowing the* Parallax *of the* Moon; *as alſo the Reaſon, why in the* Solar Eclipſe *above calculated, the* Diameter *of the* Moon *did increaſe about the end.*

I did apply my ſelf the laſt Summer to the taking of the *Diameters* of the Sun, Moon, and the other Planets, by a Method, which one M. *Picard* and my ſelf have, eſteem'd by Us the beſt of all thoſe, that have been practis'd hitherto; ſince we can take the *Diameters* to *Second Minutes*, being able to divide one foot into 24000. or 30000. parts, ſcarce failing as much as in one only part, ſo as we can in a manner be *aſſur'd*, not to deceive our ſelves in 3. or 4. *ſeconds*. I ſhall not now tell you my Obſervations, but I may very well aſſure you, that the *Diameter* of the *Sun* has not been much leſs in his *Apogee*, than 31. m. 37. or 40. ſec. and certainly not leſſe than 31. m. 35. ſec. and that at preſent in his *Perigee* it paſſes not 32. m. 45. ſec. and may be leſſe by a ſecond or two. That, which is at the preſent troubleſome, is, that the *Vertical* Diameter, which is the moſt eaſie to take, is diminiſht, even at *Noon*, by 8. or 9. ſec. becauſe of the *Refractions*, which are much greater in Winter than Summer at the ſame height; and that the *Horizontal* Diameter is difficult, becauſe of the ſwift motion of the Heavens.

As for the *Moon*, I never yet found her Diameter leſs than 29. m. 44. or 45. ſec. and I have not ſeen it paſs 33. m. or if it hath, it was only by a few *ſeconds*. But I have not yet taken her in all the kinds of ſituations of the *Apogees* and *Perigees* which happen, with the *Conjunctions* and *Quadratures*. I do not mention all, what can be deduced from thence, but if you have Perſons at *London*, that obſerve theſe *Diameters*, we may entertain our ſelves more about this Subject, another time. I ſhall only tell you, that I have found a Way to know the *Parallax* of the *Moon*, by the means of her *Diameter*: *Vid.* If on a day, when ſhe is to be in her *Apogee* or *Perigee*, and in the moſt *Boreal* Signes, you take her Diameter towards the *Horizon*, and then towards the *South*, with her *Altitudes* above

above the Horizon. For, if the Obſervation of the Diameters be exact; as in theſe Situations the Moon changes not conſiderably her Diſtance from the Earth in 6. or 7. hours, the *Difference* of the Diameters will ſhew the Proportion there is of her Diſtance, with the Semi-diameter of the Earth. I do not enlarge, becauſe that as ſoon as one hath this *Idea*, the reſt is eaſie. The ſame would yet be practis'd better in the places, where the Moon paſses through the *Zenith*, than here; for the gteater the difference is of the Heights, the greater is that of the Diameters. I do not note (for it eaſily appears) that, if one were under the ſame *Meridian*, or the ſame *Azimuth* in two very diſtant places, and took at the ſame time the Diameter of the Moon, one would do the ſame thing; though this Method goes not to preciſeneſs.

From what has been ſaid, may be collected the reaſon of the Obſervation, which M. *Hevelius* made in the laſt *Eclipſe of the Sun*, touching the increaſe of the Moon's Diameter about the end. I am exceeeding glad, that a perſon, who probably knew not the cauſe of it, has made the Experiment: but it is ſtrange, that until now no Aſtronomer has foreſeen, that that ſhould happen, nor given any precepts for the Change of the *Moons Diameter* in the *Eclipſes of the Sun*, according to the places, where they ſhould happen, and according to the Hour and Height, the Moon ſhould have. For, what hapned in that *Eclipſe* of Augmentation, would have faln o ut contrarily, if it had been in the Evening; for, the Moon, which in that *Eclipſe*, that began in the Morning, was higher about the end than at the beginning, was nearer us, and conſequently was to appear bigger: But if the *Eclipſe* ſhould happen in the Evening, ſhe would be lower at the end, and therefore more diſtant from us, and conſequently appear leſſer. So alſo in two different places, whereof one ſhould have the Eclipſe in the Morning, and the other at Noon, the Moon ſhould appear bigger to him that hath it at Noon: And ſhe muſt likewiſe appear bigger to thoſe, who ſhall have a leſſer *Elevation* of the *Pole* under the ſame *Meridian*, becauſe the Moon will be nearer them.

I wiſh, I could ſatisfie you about the *Optick Glaſſes* of Signior *Burattini* in *Poland*, which he hath ſent hither; but I have not yet ſeen their performances my ſelf. I only ſaw once the Glaſſes, which

which are perfectly well wrought and well poliſht. Thoſe, that have tried them, find them very good, but they are only, the one of 10, the other of 8. foot. A good Aſtronomer told me, that they would bear a great *Aperture* in reſpect of their length.

I do not well know, what to ſay to yours concerning M. *Hevelius*. Mean while, the intereſt of truth, and the obliging manner, he has treated me with, engage me to anſwer him, in the matter of the *Comets*: I am perſwaded, I ſhall convince him; but ſince he hath taken the *Illuſtrious Royal Society* for Judge, I accept that with all my heart.

A Relation
Of the loſs of the Way to prepare the Bononian Stone *for ſhining.*

Though ſeveral Perſons have pretended to know the Art of preparing and calcining the *Bononian* Stone, for keeping a while the Light once imbibed; yet there hath been indeed but one, who had the true ſecret of performing it. This was an *Eccleſiaſtick*, who is now dead, without having left that skill of his to any one, as Letters from *Italy* and *France*, ſome while ſince, did inform. There is no ſubſtance, in Nature, known to us, that hath the effect of this Stone; ſo that (to the ſhame of the preſent Age) this *Phænomenon* is not like to be found any where, but in Books, except ſome happy *Genius* light upon the ſame or the like skill *.

[* It is hoped notwithſtanding (which alſo a late Letter from abroad does hint) that ſome or other of the *Italian* Vertuoſi at *Florence* have ſecured this Secret.]

A Deſcription
Of a Swediſh *Stone, which affords* Sulphur, Vitriol, Allum, *and* Minium.

This was communicated to the *R. Society* by Sir *Gilbert Talbot* Knight, a Worthy Member of that Body, as he had received it in *Denmark*, being his Majeſties Extraordinary Envoy there; as follows,

THere is a Stone in *Sweden* of a Yellow Colour, intermixed with ſtreaks of white (as if compoſed of Gold and Silver) and heavy withal. It is found in firm Rocks, and runs in Veins, upon

upon which they lay Wood, and set it on fire. When the Stone is thus heated, they cast Water upon it, to make it rend, and then dig it up with Mattocks. This done, they break it into smaller pieces, and put it into Iron-pots, of the shape represented by *Figure* C; the mouth of the one going into the other. These they place, the *one* in the Oven upon an Iron fork sloping, so that, the Stone being melted, it may run into the *other*, which stands at the mouth of the Oven, supported upon an Iron. The first running of the Stone is *Sulphur*.

The remainder of the burned Stone is carry'd out, and laid upon a high Hill, where it lies expos'd to the Sun and Air for the space of two years; and then taketh fire of it self, casting forth a thin blew flame, scarce discernable in the day time. This being consumed, leaveth a blew dust behind it; which the Workmen observe, and mark with woodden pins. This they dig up, and carry into the Work-house, and put it into great Tubs of Water, where it infuseth 24. hours or more. The Water they afterward boyl in Kettles, as we do Saltpeter, and put it into cooling Tubs, wherein they place crosse Sticks, and on them the *Vitriol* fastens, as Sugar-candy doth.

The Water, that remains after the extraction of the *Vitriol*, they mix with an eight part of Urin and the Lees of Wood-ashes, which is again boyled very strong, and being set to cool in Tubbs, crosse Sticks are likewise placed, and thereon the *Allum* fastens.

In the Water, which remains after the *Allum*, is found a Sediment, which being separated from the Water, is put into an Oven, and Wood laid upon it and fired, till it become red, which makes the *Minium*, wherewith they paint their Houses, and make plaister.

So far this Description; Which gave occasion to a curious person to call to mind, That there was a kind of Stone in the *North* of *England*, yielding the same substances, except *Minium*.

A Relation
Of the Raining *of* Aſhes, *in the* Archipelago, *upon the Eruption of Mount* Veſuvius, *ſome years ago.*

This came but lately to hand from that knowing perſon, Mr. *Henry Robinſon*; and was thought fit to be now inſerted here, that it might not be loſt, though it hath hapned above 30 years ago. It was contained in a Letter, (ſubſcribed by Capt. *Will. Badily*) in theſe words:

THe 6th. of *December* 1631, being in the Gulf of *Volo*, riding at Anchor, about ten of the Clock that Night, it began to rain Sand or Aſhes, and continued till two of the Clock the next Morning. It was about two inches thick on the Deck, ſo that we caſt it over board with Shovels, as we did Snow the day before: The quantity of a Buſhel we brought home, and preſented to ſeveral Friends*, eſpecially to the Maſters of *Trinity Houſe*. There was in our Company, Capt. *John Wilds* Commander of the *Dragon*, and Capt. *Anthony Watts*, Commander of the *Eliſabeth* and *Dorcas*. There was no Wind ſtirring, when theſe Aſhes fell, it did not fall onely in the places, where we were, but likewiſe in other parts, as Ships were coming from St. *John D' Acre* to our Port; they being at that time a hundred Leagues from us. We compared the Aſhes together, and found them both one. If you deſire to ſee the Aſhes, let me know.

* Some of theſe Aſhes were produced by Mr. *John Evelyn*, before the *Royal Society*.

An Extract
Of a Letter not long ſince written from Rome, *rectifying the Relation of* Salamanders *living in Fire.*

This came from that Expert Anatomiſt M. *Steno*, to Dr. *Croon*; *Videl.* That a Knight called *Corvini*, had aſſured him, that, having caſt a *Salamander*, brought him out of the *Indies*, into the Fire, the Animal thereupon ſwell'd preſently, and then vomited ſtore of thick ſlimy matter, which did put out the neighbouring Coals, to which the *Salamander* retired immediately, putting them out again in the ſame manner, as ſoon as they re-

kindled, and by this means saving himself from the force of the Fire, for the space of two hours; the Gentleman above-mentioned being then unwilling to hazard the Creature any further: That afterwards it lived nine Months: That he had kept it eleven Months without any other food, but what it took by licking the Earth, on which it moved, and on which it had been brought out of the *Indies*; which at first was covered with a thick moisture, but being dried afterwards, the Urin of the Animal served to moisten the same. After the eleven Months, the Owner having a mind to try, how the Animal would do upon *Italian* Earth, it died three dayes after it had changed the Earth.

An Account of several Engagements for Observing of Tydes.

Since nothing is more important for discovering the Cause of that Grand *Phænomenon* of Nature, the *Flux* and *Reflux of the Sea*, than a true and full *History of the Tydes*, the *Virtuosi* of *England* have of late (especially since the Publication of Dr. *Wallis* his *Theory* touching that *Apparence*) taken care, to direct and recommend in several parts of the World, and particularly in the most proper places of these *Ilands*, such Observations, as may contribute to the elucidating of that Subject.

And as formerly they have sent their *Inquiries* of this Nature to the Isle of St. *Helena*, situated in the open Ocean beyond the *Æquinoctial*, and already received some account thereupon; so they have since dispatcht the like for the *Bermudas*, an *Isle* that hath no less conveniency of situation for that purpose. And they intend (as will more amply appear, God permitting, in a short time) to lodge with such Masters of Ships and Pilots, as shall sayl into remote parts, very particular directions of that kind, to be printed at the *Royal Societies* charges, and to be committed to the care of the Masters of *Trinity House* for disposing of them to that end.

And, as for the Observations, to be made in these Kingdoms; 'tis hoped, that the Masters in the Art of Navigation at *Bristol* (Mr. *Standridge* and Mr. *Iff*) will undertake that business with affection and care: the former of these two having already (as we are informed from a good hand) made a Collection of the Tydes,

for

for ſome years paſt, and found them differing from former Obſervations and Tables; the other promiſing future diligence in this matter; noting in the mean time, that ſome Tydes of laſt Autumn were ſo far differing from former Obſervations, that neither he, nor any others there, could make any thing of it.

We muſt not omit here to mention the readineſs, expreſſed by theſe worthy Gentlemen, Mr. *Rob. Boyle*, Sir *Rob. Moray*, and Mr. *Henry Powle*, for concurring in this Work; the firſt, having undertaken to recommend Obſervations of this nature, to be made, upon the *Weſtern* Coaſt of *Ireland**; the ſecond, upon the Weſt of *Scotland*; and the third, in the Iſle of *Lundy*; to whom we muſt adde the inquiſitive Mr. *Sam. Colepreſſe*, for *Plymouth*, and the *Lands-end*. Beſides, we hope to engage the curious of *France* in the ſame undertaking, eſpecially for procuring, beſides what is known already concerning that place, a very particular and exact account of the Tydes upon the Coaſt of *Britany*, where (eſpecially about St. *Malo*) they are found to riſe to admiration, even to 60. 70. and ſometime 80. feet, at the New and Full Moon.

* The Obſervations particularly recommended for that Coaſt, are theſe;

1. At what hour it is High-water on the day of the New and Full Moon, upon every Cape and Bay of the Weſtern Coaſt of *Ireland*.

2. How long after the New and Full Moon the higheſt Spring-tides fall out.

3. What are the perpendicular heights of the Flood, both at the ordinary, and the Spring-tydes.

Some Suggeſtions For Remedies againſt Cold.

As there have been Remedies found out againſt exceſſive *Heat*, and Means of cooling Meat and Drink; ſo it was lately, on the occaſion of the ſharp Seaſon, ſuggeſted, That Remedies might be thought on againſt *Cold*; and that particularly it might be inquired into,

1. What things in Nature, or by Art, or Mechanical contrivance will retain a warming Heat longeſt, or a melting or ſcorching Heat?

2. What will continue or maintain Fire longeſt?

Some that obſerve common practiſes and vulgar Trades, take notice, That *Joyners* uſe *Leaden-Pots* for their Glue, alledging for a Reaſon, That Lead, being a cloſe Mettal, retains the heat

longer than other Mettals. *Cary's* Warming-ſtone promiſed a warmth for ſix or eight hours; if it performed but for two or three hours, it would be of great uſe. 'Tis found by ſad experience, how hurtful Bright Fires, and eſpecially of Stone-coal are to the Eyes.

To retain Fire long, certain *Black* Earths are uſeful, as we were newly informed by the Inquiſitive Dr. *B.* That a Gentleman in *Sommertſetſhire*, called Mr. *Speke*, had bountifully obliged *Ilminſter*, and his Neighborhood, by a Black Fat-Earth lately found in his Park. But the ſame Correſpondent adds, That he never ſaw any parallel to a *Sea-weed*, which he and ſome of his Fellow-Students had in *Cambridge* in the mouth of a Barrel of good Oyſters. It was ſmaller than Peaſe-halm, yet cut, it laſted two very great Fires of Sea-coal, burning bright in the midſt of the Fire; and by a ſtroak of the Tongues, it fell into the Hearth, jingling like Mettal.

A Relation
Of an uncommon Accident in two Aged Perſons.

This was imparted by the above-mentioned Mr. *Colepreſſe*, who aſſures in his Letter, containing this Account, That the matter of fact was thorowly examined by himſelf, and that he was fully, and in all reſpects, ſatisfied of the truth thereof.

The Relation of the one, is in theſe words.

Joſeph Shute Clerk, Parſon of *Mary* (nigh *Plymouth*) in the County of *Devon*, aged 81 years, being a temperate man, and of an healthy conſtitution, having the in-moſt Grinder looſe, and ſo remaining, perceived, that his mouth, about three Moneths ſince, was ſomewhat ſtreightned; and upon inquiry into the cauſe of it, found, That he had a new Tooth (the third Grinder) being the innermoſt of the upper Jaw in the Right Cheek, which ſtill remains firm.

The Account of the other follows thus.

Maria Stert of *Benecliffe*, in *Plympton St. Mary* (near *Plymouth*) in *Devon*, aged about 75 years, an healthy perſon, having had nine children, about the fortieth year of her age loſt three of her upper

upper *Inciſores* or *Cutters*, the other drawn out, and ſo remained Toothleſs, as to them, for about 25 years, when ſhe perceived, that a new Tooth came forth (without any pain) next the *Canini* of the left Check: And about two years after, another Tooth grew out likewiſe without pain, cloſe by the former. The firſt whereof, never came to above half the length of her former *Cutters*, the latter ſcarce breaking the skin: Both which yet proved ſerviceable, till about ſix weeks ſince, when ſhe eating (no hard, cruſty, or ſolid) Meat, that Tooth which came out firſt, fell down into her Mouth, without any looſneſs before hand perceived, or any pain; which had not a phang like other *Cutters*, but much leſs, and ſhorter. The other abides firm, aud ſerviceable.

To the truth of theſe Relations, not onely the ſaid *Joſeph Shute* and *Maria Stert*, have put the one his name, the other her Mark, the third and ſeventh of *January*, 1666. but alſo Sir *William Strode*, and Mr. *Colepreſſe* have ſubſcribed the ſame, as believing the Relation to be true.

An Account of two Books.

I. ISMAELIS BULLIALDI *ad Aſtronomos Monita duo: Primum, De Stella Nova, quæ in Collo Ceti ante annos aliquot viſa eſt. Alterum, De Nebuloſa in Andromedæ Cinguli parte Borea, ante biennium iterum orta.*

The chief end of the *Author* in publiſhing this Tract, ſeems to be, To excite Aſtronomers to a diligent obſervation, both of that *New Star* in the *Neck* of the *Whale*, to be ſeen in *February* and *March* next; and of that other, in the Northern part of *Andromeda's Girdle*, to be ſeen at this very preſent.

As to the *former* of theſe Stars, *he affirms*, that, as it hath appeared for many years in the ſaid place, ſo it will in the beginning of *March* next appear equal to the Stars of the *third Magnitude*, or perhaps bigger; and that about the end of the ſame Month, if the Crepuſcle do not hinder, the greateſt *Phaſis* of it will appear, if ſo be, that it keep the ſame Analogy of Motions and Periods, which it obſerved from *An.* 1638. to *An.* 1664. Where he takes notice of the Cauſes, why its two greateſt Appearances could not be ſeen, *An.* 1664, 1665, 1666; and how he comes

comes to know, that in the beginning of *March* next, it will equal, or even exceed the Stars of the *Third Magnitude*; noting, that from the Obſervations hitherto made of this Star, it is manifeſt, that the *greateſt Phaſes* thereof do every year anticipate by 32. or 33. dayes; foraſmuch as *An.* 1660. its *greateſt Appearance* was about the end of *October* and the beginning of *November*; *An.* 1661. about the end of *September*, or the beginning of *October*; *An.* 1662. about the end of *Auguſt*, *&c.* ſo that this year it muſt be in *March*, if the former Analogy do hold.

He collects alſo from the Obſervations, That one *Period* from the *greateſt Phaſis* to the next, conſiſts of about 333. dayes: but that the interval of the time betwixt the times of its beginning to appear equal to the Stars of the *Sixt Magnitude*, and of its ending to do ſo, conſiſts of about 120. dayes: And that its *greateſt Appearance* laſts about 15. dayes: All which yet he would have underſtood with ſome latitude.

This done, he proceeds to the inveſtigation of the Cauſes of the Viciſſitudes in the Emerſion and Diſ-appearance of this Star, and having diſcourſed, That the apparent Increaſe and Decrement of every Lucid Body proceeds *either* from its changed diſtance from the Eye of the Obſerver; *or* from its various ſite and poſition in reſpect of him, whereby the angle of Viſion is changed; or from the increaſe or diminution of the bulk of the lucid body it ſelf: and having alſo demonſtrated it impoſſible, that this Star ſhould move in a *Circle*, or in an *Ellipſis*; and proved it improbable that it ſhould move in a *Strait Line*; he concludes, that there can be no other genuin, or at leaſt, no other more probable cauſe of its Emerſion and Occultation, than this, That the bigger part of that round Body is obſcure and inconſpicuous to us, and its leſſer part lucid, the whole Body turning about its own Center, and one Axe; whereby for one determinate ſpace of time it exhibits its lucid part to the Earth, for another, ſubducts it: it not being likely, that fires ſhould be kindled in the Body of that Star, and that the matter thereof ſhould at certain times take fire and ſhine, at other times be extinguiſht upon the conſumption of that matter.

So far of that Star. As to the other in the *Girdle* of *Andromeda*, ſeen about the beginning of *An.* 1665; he relates, that, when in the end of 1664. the World beheld the then appearing *Comet*, Aſtro-

Astronomers observed also this new *Phænomenon*, which was called by them *Nebulosa in Cingulo Andromedæ*. Concerning which he notes, that the same had been already seen many years before by *Simon Marius*, vid. *An.* 1612. when with a *Telescope* he search'd for the *Satellits* of *Jupiter*, and observed their motions; alledging for proof hereof, the said *Authors* own words, out of his own Book, *De Mundo Joviali*, publisht *An.* 1614. And farther shews, that it hath formerly appear'd (about 150. years ago) and been taken notice off by an expert, though Anonymous, Astronomer; whose words he cites out of a *Manuscript*, brought out of *Holland* by the Excellent *Jacobus Augustus Thuanus*, returning from his Embassy to *Paris*; wherein also was marked the *Figure* of that *Phænomenon*, represented in print by our Author: who from all this collects, that, whereas this Star hath been seen formerly, and that 150. years since, but yet neither observed by *Hipparchus*, nor any other of the Antients, that we can find; nor also in the former Age by *Tycho Brahe*, nor in our Age, by *Bayerus*; and appear'd also in the Month of *November* last (wherein he wrote this *Tract*) much lessened and obscure, after it had, two years ago, shone very bright; that therefore it must needs appear and dis-appear by turns, like those in the *Necks* of the *Whale* and *Swan*.

II. *ENTRIENS sur les Vies et sur les Ouvrages* Des plus excellens Peintres, Anciens et Modernes, par Monsieur *FELIBIEN*.

This Author, having first discourst of that Royal Pallace the *Louvre*, and the Designs of finishing it; passes on to the Art of *Picturing*, and treats of the three principal things, wherein a good Master of the Art must excel, *vid.* the Composition, Designing, and Laying on of Colours, which done, he ravels into the Origine, and deduces the Progress of Painting, and relates what is most remarkable in the Lives of the Antient Painters: And among many particulars, he observes in the Life of *Andreas de Sarte*, how difficult it is, to judge well of a Picture; relating, that a Duke of *Mantua*, having obtained of *Clement* VII. a Pourtrait of *Leo* X. which had been done by *Raphael Urbin*, and was at *Florence*, those of that Town being unwilling to lose so excellent a piece,

piece, caused a Copy thereof to be made by the said *Andreas de Sarte*, which they sent instead of the Original. This *Copy* was so perfect, that *Julio Romano*, who had been bred and taught by *Raphael*, and was one of the best Painters of *Italy*, took it for an *Original*; and would never have been undeceived, if one *Vasari* had not assured him, that it was but a Copy, which himself had seen made, and had not shew'd him certain marks, that were there put to discriminate it from the Original.

In the *Second* Part, the Author has set down all that is requisite to judge and discourse well of Painting. But, to add Examples to Precepts, he discourses of the *Modern* Painters, and making a Description of their best Works, he takes occasion to observe, what is there found most excellent, and to shew, how they have put in practice the Rules of Art. He treats also of the declining of Painting, and affirms, that nothing considerable hath been done in it from the time of *Constantine*, till *An.* 1240. when one, *Cimabue*, began to raise this Art again. After this, he gives a List of the Painters, that since have been famous for their Works, preferring before all others, *Raphael Urbin*. The last of all is the above-mention'd *Andre de Sartes*, who died, *An.* 1530. and whom the liberality of *Francis* I. had drawn into *France*.

The Printing of these Tracts is now return'd to the first Printer thereof, as being somewhat re-setled after the late sad Fire of *London*.

F I N I S.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be sold at his Shop a little without Temple-Bar, 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, February 11. 1666.

The Contents.

Trials propoſed to be made for the Improvement of the Experiment of Transfuſing Blood out of one live Animal into another. *A Method for* Obſerving the Eclipſes of the Moon, *free from the Common Inconveniences. An Account of ſome Celeſtial Obſervations lately made at* Madrid. *Extract of a Letter, lately written to the Publiſher, containing ſome Obſervations about* Inſects *and their Inoxiouſneſs, &c. An Account of ſome Books*, vid. I. TOME TROISIEME DES LETTRES DE M. DESCARTES. II. ASTRONOMIA REFORMATA P. RICCIOLI. III. ANATOME MEDULLÆ SPINALIS ET NERVORUM, *inde provenientium,* GERARDI BLASII, *M. D. An Advertiſement about the re-printing of M.* Evelyns *Sylva and Pomona. A* Table *of the* Tranſactions, *printed theſe two years.*

Tryals propoſed by Mr. Boyle *to Dr.* Lower, *to be made by him, for the Improvement of Tranſuſing Blood out of one live Animal into another; promiſed* Numb. 20. p. 357.

THe following *Quæries* and *Tryals* were written long ſince, and read about a Moneth ago in the *R Society*, and do now come forth againſt the Authors intention, at the earneſt deſire of ſome Learned Perſons, and particularly of the worthy *Doctor*, to whom they were addreſſed; who thinks, they may excite and aſſiſt others in a matter, which, to be well proſecuted, will require many hands. At the reading of them, the *Author* declared, that of divers of them he thought he could fore-ſee the Events, but

yet judged it fit, not to omit them, becauſe the Importance of the *Theories*, they may give light to, may make the Tryals recompence the pains, whether the ſucceſs favour the *Affirmative* or the *Negative* of the Queſtion, by enabling us to determine the one or the other upon ſurer grounds, than we could otherwiſe do. And this Advertiſement he deſires may be applied to thoſe other Papers of his, that conſiſt of *Quæries* or propoſed *Tryals*.

The Quæries *themſelves follow.*

1. Whether by this way of Transfuſing Blood, the diſpoſition of Individual Animals of the ſame kind, may not be much altered? (As whether a *fierce* Dog, by being often quite new ſtocked with the blood of a *cowardly* Dog, may not become more tame; *& vice verſa, &c.*?)

2. Whether immediately upon the unbinding of a Dog, repleniſht with adventitious blood, he will know and fawn upon his Maſter; and do the like cuſtomary things as before? And whether he will do ſuch things better or worſe at ſome time after the Operation?

3. Whether thoſe Dogs, that have *Peculiarities*, will have them either aboliſht, or at leaſt much impaired by transfuſion of blood? (As whether the blood of a *Maſtiff*, being frequently transfuſed into a *Blood-hound*, or a *Spaniel*, will not prejudice them in point of ſcent?)

4. Whether acquired Habits will be deſtroy'd or impair'd by this Experiment? (As whether a Dog, taught to fetch and carry, or to dive after Ducks, or to ſett, will after frequent and full recruits of the blood of Dogs unfit for thoſe Exerciſes, be as good at them, as before?)

5. Whether any conſiderable change is to be obſerv'd in the Pulſe, Urin, and other Excrements of the *Recipient* Animal, by this Operation, or the quantity of his inſenſible Tranſpiration?

6. Whether the *Emittent* Dog, being full fed at ſuch a diſtance of time before the Operation, that the maſs of blood may be ſuppos'd to abound with *Chyle*, the *Recipient* Dog, being before hungry, will loſe his appetite, more than if the *Emittent* Dogs blood had not been ſo chylous? And how long, upon a Vein

Vein opened of a Dog, the admitted blood will be found to retain *Chyle?*

7. Whether a Dog may be kept alive without eating by the frequent Injection of the Chyle of another, taken freshly from the Receptacle, into the Veins of the *Recipient* Dog?

8. Whether a Dog, that is *sick* of some disease chiefly imputable to the mass of blood, may be cured by exchanging it for that of a *sound* Dog? And whether a *sound* Dog may receive such diseases from the blood of a *sick* one, as are not otherwise of an infectious nature?

9. What will be the Operation of frequently stocking (which is feasible enough) an *old* and feeble Dog with the blood of *young* ones, as to livelinesse, dulnesse, drowsinesse, squeamishnesse, &c. *et vice versa?*

10. Whether a *small* young Dog, by being often fresh stockt with the blood of a young Dog of a *larger* kind, will grow bigger, than the ordinary size of his own kind?

11. Whether any Medicated Liquors may be injected together with the blood into the *Recipient* Dog? And in case they may, whether there will be any considerable difference found between the separations made on this occasion, and those, which would be made, in case such Medicated Liquors had been injected with some other Vehicle, or alone, or taken in at the mouth?

12. Whether a Purging Medicine, being given to the *Emittent* Dog a while before the Operation, the *Recipient* Dog will be thereby purged, and how? (which Experiment may be hugely varied.)

13. Whether the Operation may be successfully practis'd, in case the injected blood be that of an Animal of another *Species*, as of a *Calf* into a *Dog*, &c. and of a *Cold* Animal, as of a *Fish*, or *Frog*, or *Tortoise*, into the Vessels of a *Hot* Animal, and *vice versa?*

14. Whether the *Colour* of the Hair or Feathers of the *Recipient* Animal, by the frequent repeating of this Operation, will be changed into that of the *Emittent?*

15. Whether by frequently transfusing into the same Dog, the blood of some Animal of another *Species*, something further, and more tending to some degrees of a change of *Species*, may

be effected, at leaſt in Animals near of Kin; (As Spaniels and Setting Dogs, Iriſh Grey-hounds and ordinary Grey-hounds, &c.)

16. Whether the Tranſfuſion may be practis'd upon pregnant Bitches, at leaſt at certain times of their gravidation? And what effect it will have upon the Whelps?

There were ſome other *Quæries* propoſed by the ſame *Author*; as, the weighing of the *Emittent* Animal before the Operation, that (making an abatement for the Effluviums, and for the Excrements, if it voids any) it may appear, how much blood it really loſes. To which were annext divers others not ſo fit to be peruſed but by *Phyſitians*, and therefore here omitted.

A Method

For Obſerving the Eclipſes of the Moon, *free from the Common Inconveniencies, as it was left by the Learned Mr.* Rook, *late* Greſham-*Profeſſor of Geometry.*

ECliples of the Moon are obſerved for two principal ends; One *Aſtronomical*, that by comparing Obſervations with Calculations, the *Theory* of the *Moons Motion* may be perfected, and the *Tables* thereof reformed: the other, *Geographical*, that by comparing among themſelves the Obſervations of the ſame *Ecliptick Phaſes*, made in *divers* places, the *Difference* of *Meridians* or *Longitudes* of thoſe places may be diſcerned.

The Knowledge of the Eclipſe's Quantity and Duration, the Shadows, Curvity, and Inclination, &c. conduce only to the former of theſe ends. The exact time of the Beginning, Middle, and End of Eclipſes, as alſo in *Total* ones, the Beginning and End of *Total* darkneſs, is uſeful for both of them.

But becauſe in Obſervations made by the *bare* Eye, theſe times conſiderably differ from thoſe with a *Teleſcope*; and becauſe the *Beginning* of Eclipſes, and the *End* of *Total* darkneſs, are ſcarce to be obſerved exactly, even with Glaſſes (none being able clearly to diſtinguiſh between the *True* Shadow and *Penumbra*, unleſs he hath ſeen, for ſome time before, the Line, ſeparating them, paſs along upon the Surface of the Moon;) and laſtly, becauſe in ſmall

Partial

Partial Eclipſes, the Beginning and End, and in *Total* ones of ſhort continuance in the Shadow, the Beginning and End of *Total* darkneſs, are unfit for nice Obſervations, by reaſon of the ſlow change of *Apparences*, which the *Oblique* Motion of the Shadow then cauſeth. For theſe reaſons I ſhall propound a *Method* peculiarly deſign'd for the Accompliſhment of the *Geographical* end in Obſerving Lunar Eclipſes, free (as far as is poſſible) from all the mentioned Inconveniences.

For, *Firſt*, It ſhall not be practicable without a Teleſcope. *Secondly*, The Obſerver ſhall alwayes have opportunity before his principal Obſervation, to note the Diſtinction between the *True Shadow* and the *Penumbra*. And, *Thirdly*, It ſhall be applicable to thoſe Seaſons of the Eclipſe, when there is the ſuddeneſt Alteration in the *Apparences*.

To ſatisfie all which intents,

Let there be of the Eminenteſt *Spots*, diſperſed over all Quarters of the Moons Surface, a ſelect number generally agreed on, to be conſtantly made uſe of, to this purpoſe, in all parts of the World. As, for Example, thoſe, which *M. Hevelius* calleth,

Mons: *Sinai*. *Ætna*. *Porphyrites*. *Serorum*.

Inſula: *Besbicus*. *Creta*.

Palus: *Mæotis*. *Maræotis*.

Lacus Niger Major.

Let in each *Eclipſe*, not all, but (for inſtance) three of theſe *Spots*, which then lie neareſt to the *Ecliptick*, be exactly obſerved, when they are firſt touch'd by the *True* Shadow, and again, when they are juſt compleatly entred into it, and (if you pleaſe) alſo in the *Decreaſe* of the Eclipſe, when they are firſt fully clear from the *True* Shadow: For the accurate determinations of which moments of time (that being in this buſineſs of main importance) let there be taken *Altitudes* of remarkable *Fixed Stars*; on this

ſide

ſide of the *Line*, of ſuch, as lie between the *Æquator* and *Tropick* of *Cancer*; but *beyond* the *Line*, of ſuch, as are ſituate towards the other *Tropick*; and in all places, of ſuch, as at the time of Obſervation, are about 4. hours diſtant from the *Meridian*.

An Account
Of ſome Obſervations, lately made in Spain, *by His Excellency the* Earl of Sandwich.

THe Right Honourable the *Earl of Sandwich*, as he appears eminent in diſcharging the Truſt, his Majeſty hath repoſed in him, of Ambaſſador Extraordinary to the King of *Spain*; ſo he forgets not in the midſt of that Employment, that he is a Member of the *Royal Society*; but does from time to time, when his weighty State-Negotiations do permit, imploy himſelf in making conſiderable Obſervations of divers kinds, both *Aſtronomical* and *Phyſiological*; and communicateth the ſame to the ſaid *Society*; as for inſtance, lately, what he has obſerv'd concerning the *Solar Eclipſe* in *June* laſt, the Suns height in the Solſtice, and alſo the Latitude of *Madrid*, eſteeming by the Suns Altitude in the *Solſtice*, and by other Meridian Altitudes, the *Latitude* of *Madrid* to be 40 deg. 10 min; which differs conſiderably from that aſſigned by others; the General Chart of *Europe* giving to it 41 deg. 30 min. the General Map of *Spain*, 40 deg. 27 min. A large Provincial Map of *Caſtile*, 40 deg. 38 min.

To theſe particulars, and others formerly imparted, his Excellency is making more of the ſame nature; and particularly thoſe of the Immerſion of the *Satellites* of *Jupiter*.

We muſt not omit mentioning here, what he hath obſerved of *Halo*'s about the *Moon*; which he relates in theſe words;

Decemb. 25. *Old Style*, 1666. In the Evening, here (vid. at *Madrid*) was a great *Halo* about the Moon, the *Semidiameter* whereof was about 23 deg. 30 min. *Aldebaran* was juſt in the *North-eaſt* part of the *Circle*, and the two Horns of *Aries* juſt encloſed by the *South-weſt* of the *Circle*, the Moon being in the *Center*. I note this the rather (*ſaith he*) becauſe five or ſix years ago, vid. *Novemb.* 21. *Old Style*, 1661. an hour after Sun-ſet, I ſaw a great *Halo* about the Moon of the ſame *Semidiameter*,

at

at *Tangier*, the Moon being very near the ſame place, where ſhe was now.

Extract

Of a Letter, lately written by Mr. Nathaniel Fairfax *to the* Publiſher, *containing Obſervations about ſome* Inſects, *and their Inoxiouſneſs, &c.*

The Ingenious Author of this Letter, as he expreſſes an extraordinary deſire to ſee the *Store-houſe* of *Natural Philoſophy*, more richly fraughted (a Work begun by the ſingle care and conduct of the Excellent Lord *Verulam*, and proſecuted by the Joynt-undertakings of the *R. Society*) ſo he very frankly offers his Service in contributing ſome of his Obſervations, and begins in this very Letter to perform his Offer. For, Having taken notice of what was publiſhit in *Numb. 9. p. 161.* out of the *Italian* Philoſopher *Redi*, vid. That Creatures, reputed Venomous, are indeed no Poyſons, when ſwallow'd, though they may prove ſo, when put into Wounds: He, for confirmation thereof, alledges Examples of ſeveral Perſons well known to him (himſelf alſo having been an Eye-witneſs to ſome ſuch Experiments) who have frequently ſwallow'd *Spiders*, even of the rankeſt kind, without any more harm than happens to Hens, Robin-red-breaſts, and other Birds, who make Spiders their daily Commons. And having made mention of ſome men, that eat even *Toads*, he adds, that though a Toad be not a Poyſon to us in the whole; yet it may invenome outwardly, according to ſome parts ſo and ſo ſtirr'd; an inſtance whereof he alledges in a Boy, who ſtumbling on a Toad, and hurling ſtones at it, ſome Juyce from the bruiſed Toad chanced to light upon his Lips, whereupon they ſwell'd, each to the thickneſs of about two Thumbs: And he neglecting to uſe, what might be proper to reſtore them, they have continued in that miſhapen ſize ever ſince; the uglineſs whereof, when the Relator ſaw, gave him occaſion to inquire after the cauſe of it, which thereupon he underſtood to be, as has been recited.

On this occaſion, the ſame Gentleman relates, that once ſeeing a Spider bruiſed into a ſmall Glaſs of Water, and that it tinged

it

it ſomewhat of a Sky-colour, he was, upon owning his ſurpriſe thereat, informed, that a dozen of them being put in, they would dye it to almoſt a full *Azure*. Which is touch't here, that, the Experiment being ſo eaſie to make, it may be tried, when the ſeaſon furniſhes thoſe Inſects; mean time, it ſeems not more incredible, that this Creature ſhould yield a Sky-colour, when put in water, than that *Cochineel*, which alſo is but an Inſect, ſhould afford a fine *red*, when ſteep'd in the ſame Liquor.

An Account
Of Some Books.

I. Le Tome troiſieme et dernier des Lettres de *M. DES-CARTES.*

As the two firſt *Tomes* of M. *Des-Cartes* his Letters, contain Queſtions, for the moſt part of a *Moral* and *Phyſiological* Nature, propoſed to, and anſwer'd by him; ſo *this* conſiſts of the Conteſts, he had upon ſeveral Subjects with divers Men eminent in his time.

To paſs by that ſharp Conteſt, he was engaged in by ſome Profeſſors of Divinity at *Utrecht*, who endeavoured to diſcredit his Philoſophy, as leading to Libertiniſme and Atheiſme, notwithſtanding he made it ſo much his buſineſs, as to aſſert the Exiſtence of a Deity, and the Immortality of a Soul: We ſhall take notice of what is more to our purpoſe, *vid.* the Differences, he had touching his *Dioptricks* and *Geometry*.

As for his *Dioptricks*, though a great part of the Learned World have much eſteem'd that Treatiſe, as leaving little to be ſaid after him upon that Subject; yet there have not been wanting Mathematicians, who have declared their diſagreement from his Principles in that Doctrine. The firſt of them was the Jeſuit *Fourdin*, Mathematick Profeſſor in the Colledg of *Clermont* at *Paris*; but this difference was ſoon at an end. A ſecond was Mr. *Hobbs*, upon whoſe account he wrote ſeveral Letters to *Merſennus*, containing many remarks conducing to the Knowledge of the Nature of *Reflection* and *Refraction*. But the Perſon, that did moſt learnedly and reſolutely attack the ſaid *Dioptricks*, was Monſieur *Fermat*, writing

writing first about it to *Mersennus*, who soon communicated his Objections to M. *Des-Cartes*, who failed not to return his Answer to them. But *Fermat* replied, and *Des-Cartes* likewise; and after many reciprocations, in which each party pretended to have the advantage, the matter rested; until M. *Fermat* taking occasion to write afresh of it to M. *De la Chambre*, several years after *Des-Cartes*'s death, upon occasion of a Book, written by M. *De la Chambre*, *Of Light*; discoursed with this new *Author* after the same rate, as he had done before with *Des-Cartes* himself, and seemed to invite some-body of his friends, to re-assume the former contest. Whereupon M. *Clerselier* and M. *Rohault* took up the Gantlet, to assert the Doctrine of the deceased Philosopher, exchanging several Letters with M. *Fermat*, all inserted in this *Tome*, and serving fully to instruct the Reader of this Difference, and withal to elucidate many difficult points of the Subject of *Refractions*; especially of this particular, *Whether the Motion of Light is more easily, and with more expedition, perform'd through* dense *Mediums, than* rare.

Besides this, though one would think, Disputes had no place in *Geometry*, since all proofs there, are as many Demonstrations; yet M. *Des-Cartes* hath had several scusles touching that Science. As M. *Fermat* had assaulted his *Dioptricks*, so He reciprocally examined his Treatise *De Maximis & Minimis*, pretending to have met with *Paralogismes* in it. But the Cause of M. *Fermat* was learnedly pleaded for, by some of his Friends, who took their turn to examine the Treatise of *Des-Cartes*'s Geometry; whereupon many *Letters* were exchanged, to be found in this Book, and deserving to be considered; which doubtless the Curious would easily be induced to do, if Copies of this Book were to be obtain'd here in *England*, besides that one, which the *Publisher* received from his *Parisian* Correspondent, and which affords him the opportunity of giving this, though but Cursory, Account of it.

As to *Physicks*, there occur chiefly two Questions, learnedly treated of in this *Volume*; though not without some heat between M. *Des-Cartes* and M. *Roberval*. The *one* is, touching the Vibrations of Bodies suspended in the Air, and their Center of Agitation: about which, there is also a Letter inserted of

M. *Des-Cartes* to that late Noble and Learned Engliſh Knight, Sir *Charles Cavendiſh*. The *other* is, whether Motion can be made without ſuppoſing a *Vacuum*: where 'tis repreſented, That, if one comprehend well the Nature, aſcribed to the *Materia ſubtilis*, and how Motions, called *Circular*, are made, which need not be juſt *Ovals* or *true* Circles, but are only called Circular, in regard that their Motion ends, where it had begun, whatever irregularity there be in the Middle; and alſo, that all the Inequalities, that may be in the Magnitude or Figure of the parts, may be compenſated by other inequalities, met with in their Swiftneſs, and by the facility, with which the parts of the *Subtle Matter*, or of the firſt *Carteſian* Element, which are found every where, happen to be divided, or to accommodate their Figure to the Space, they are to fill up: If theſe things be well underſtood and conſidered, that then no difficulty can remain touching the Motion of the parts of Matter *in pleno*.

Beſides all theſe particulars, treated of in this *Tome*, there occur many pretty Queſtions concerning *Numbers*, the *Cycloid*, the manner of *Working Glaſſes for Teleſcopes*, the way of *Weighing Air*, and many other Curioſities, Mathematical and Phyſical.

II. ASTRONOMIA REFORMATA, *Auctore* JOHANNE BAPT. RICCIOLI, *Soc. Jeſu*.

For the Notice of this Book, and the Account of the Chief Heads contained therein, we are obliged to the *Journal des Scavans*; which informs us,

Firſt, That the Deſign of this Work is, that, becauſe ſeveral *Aſtronomers*, having had their ſeveral *Hypotheſes*, there is found ſo great a diverſity of opinions, that it is difficult thence to conclude any thing certain; this Author judged it alſo neceſſary, to compare together all the beſt Obſervations, and upon examination of what they have moſt certain in them, to reform upon that meaſure the Principles of *Aſtronomy*.

Secondly, That this *Volume* is divided into two Parts; whereof the *Firſt* is compoſed of *Ten* Books; in which the Author conſi-

conſiders the principal Obſervations, hitherto made of the Motion of the Planets and the Fixed Stars, of their Magnitude, Figure, and other Accidents; drawing thence ſeveral Concluſions, in which he eſtabliſhes his *Hypotheſis*. The *Second* contains his *Aſtronomical Tables*, made according to the *Hypotheſes* of the Firſt Part, together with Inſtructions teaching the manner of uſing them.

Thirdly, That Aſtronomers will find in this Book many very remarkable things, concerning the *Apparent Diameter of the Sun* and the other Stars, the Motion of the *Libration of the Moon*, the *Eclipſes*, *Parallaxes*, and *Refractions*: And that this Author ſhews, that there is a great difference between *Optical* and *Aſtronomical* Refraction, which *Tycho* and many others have confounded; undertaking to prove, that, whereas theſe *Aſtronomers* have believed, that the remoter any Star is, the leſs is its Refraction, on the contrary the Refraction is the greater, the more a Star is diſtant. And among many other things, he ingeniouſly explicates the two contary Motions of the Sun, from Eaſt to Weſt, and *vice verſa*, by one onely Motion upon a *Spiral*, turning about a *Cone*.

Fourthly, That he repreſents, How uneaſie it is to eſtabliſh ſure Principles of this Science, by reaſon of the difficulties of making exact Obſervations. So, for example, in the Obſervation of the *Equinox*, every one is miſtaken by ſo many *Hours*, as he is of *Minutes*, in the Elevation of the *Pole*, or the Diameter of the Sun, or the Refraction, or in any other circumſtance. In the Obſervation of the *Solſtice*, the error of one only *Second* cauſeth a miſtake of an *Hour* and an *half*: mean time 'tis almoſt impoſſible to avoid the error of a *Second*; and even the ſharpeſt ſight will not be able to perceive it, except it be aſſiſted with an Inſtrument of a prodigious bigneſs. For to mark *Seconds*, though Lines were drawn as ſubtil as the ſingle threds of a Silk-worms Clew, (which are the ſmalleſt ſpaces to be diſcerned by the ſharpeſt Eye) by the Calculation made by this Author there would need an Inſtrument of 48. feet *Radius*, ſince Experience ſhews, that there needs no more at moſt, than 3600. threds of Silk to cover the ſpace of an *inch*. But, ſuppoſe one could have a *Quadrant* of this bigneſs, who can aſſure himſelf, that dividing it into

324000. parts (for ſo many *Seconds* there are in 90. *Degrees*) either in placing it, or in obſerving, he ſhall not miſtake the thickneſs of a ſingle thred of Silk? He adds, that Great Inſtruments have their defects, as the ſmall ones: For in thoſe, that are *Movable*, if the thred, on which the Lead hangs, is any thing big, it cannot exactly mark *Seconds*; if it be very fine, it breaks, becauſe of its great length, and the weight of the Lead: And in the *Fixed* ones, the greater the *Diameter* is, the leſs the Shadow or the Light is terminated; ſo that it is painful enough, exactly to diſcern the extremities thereof. Yet 'tis certain, that the greater the Inſtruments are, the ſurer *Aſtronomers* may be: Whence it is, that ſome *Aſtronomers* have made uſe of *Obelisks* of a vaſt bigneſs, to take the *Altitudes*; and Signior *Caſſini*, after the example of *Egnatio Dante*, cauſed a hole to be made on the higheſt part of a Wall of 95. feet in a Church at *Bononia*, through which the beams of the Sun falling on the Floor, mark as exactly as is poſſible, the height of that Luminary.

Fifthly, That the Author reaſons for the *Immobility of the Earth* after this manner. He ſuppoſes for certain, that the ſwiftneſs of the Motion of heavy bodies doth ſtill *increaſe* in their deſcent; to confirm which principle, he affirms to have experimented, That, if you let fall a Ball into one of the Scales of a Ballance, according to the proportion of the height, it falls from, it raiſeth different weights in the other Scale. For example, A Wooden Ball, of $1\frac{1}{2}$ ounce, falling from a height of 35 inches, raiſeth a weight of 5. ounces; from the height of 140 inches, a weight of 20 ounces; from that of 315 inches, one of 45 ounces; and from another of 560 inches, one of 80 ounces, *&c.* From this principle he concludes the Earth to be at Reſt; for, *ſaith he*, if it ſhould have a Diurnal Motion upon its Center, Heavy Bodies being carried along with it by its motion, would in deſcending deſcribe a *Curve Line*, and, as he ſhews by a *Calculus*, made by him, run equal ſpaces in equal times; whence it follows, that the Celerity of their Motion would not increaſe in deſcending, and that conſequently their ſtroke would not be ſtronger, after they had fallen thorow a longer ſpace.

III. ANA-

III. ANATOME MEDULLAE SPINALIS, ET NERVORUM *inde provenientium*, GERARDI BLASII, *M. D.*

The Author ſhews in this little *Tract* a way of taking the entire *Medulla Spinalis*, or Marrow of the Back, out of its *Theca* or Bony Receptacle, *without Laceration*; which elſe happens frequently, both of the Nerves proceeding from it, and of the Coats inveſting it; not to name other parts of the ſame. This he affirms to have been put into practice by himſelf, by a fine Saw and Wedge; which are to be dexterouſly uſed: and he produceth accordingly in excellent Cuts, the Repreſentations of the Structure of the ſaid *Medulla* thus taken out, and the *Nerves*, thence proceeding; and that of ſeveral Animals, Dogs, Swine, Sheep.

He intermixes ſeveral Obſervations, touching the *Singleneſs* of this *Medulla*, againſt *Lindanus* and others; its *Original*, vid. Whether it be the Root of the Brain, or the Brain the Root of it: its difference of *Softneſs* and *Hardneſs* in ſeveral Animals; where he notes, that in *Swine* it is much ſofter than in Dogs, *&c.*

He exhibits alſo the Arteries, Nerves, and Veins, diſperſed through this *Medulla*, and inquires, Whether the *Nerves* proceed from the *Medulla* it ſelf, or its *Meninx*; and diſcourſes alſo of the *Principle* and *Diſtribution* of the Nerves; referring for ampler information in this and the other particulars, to that Excellent Book of the Learned Dr. *Willis*, *De Anatome Cerebri.*

*Adverti*ſ*ement.*

Advertiſement.

It was thought fit to publiſh here the following *Advertiſement* of *John Evelyn* Eſquire, and that as himſelf propoſed it. *Viz.*

BEing much ſolicited by many worthy Perſons, to publiſh a *Second Edition* of my Diſcourſe and Directions concerning *Timber*, *&c.* which was printed at the Command and by the Encouragement of the *R. Society*, I do humbly requeſt, that if any Perſon have any Material Additions or Reformations, which he thinks neceſſary either to the Part, which concerns the Improvement of *Forreſt-Trees*, or that of *Cider*, he would be pleaſed to communicate his Notes and Directions to Mr. *H. Oldenburgh*, one of the Secretaries of the ſaid Society, at his Houſe in the *Palmal* of *St. James's Fields Weſtminſter*, with what ſpeed they conveniently can, before our *Lady-day* next, to be inſerted into this intended *Edition.*

Note,

What was obſerved, Numb. 20. *p.* 364. *l.* 18. *of the Number of* Vegetables, (*vid.* That they are about 410.) *found in* England; *and catalogued by Dr.* Merret *in his* Pinax, *&c. is to be underſtood only of the* different Kinds *of Plants, not of the ſeveral ſorts of ſeveral Plants; for, theſe being compriſed, the Number will amount to about* 1400.

THE

THE PHILOSOPHICAL TRANSACTIONS OF

Two Years, 1665 and 1666, beginning *March* 6. 1665. and ending with *February* 1666; abbreviated in an ALPHABETICAL TABLE: And alſo afterwards Digeſted into a more *NATURAL METHOD.*

In the TABLE, the firſt *Figure* ſignifies the *Number* of the *Tracts*: the ſecond, the *Page*, as it is remarked in the ſame.

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That though in this laſt Head there is repeated the *Tranſfuſion* of Blood, becauſe the Operation is an Art requiring diligence, and a practiſed hand to perform it for all advantagious Diſcoveries, and ſo to be diſtinguiſh'd from the *Anatomical* Account; yet that there is not affected noiſe and number, may well appear by reviewing and comparing the particulars of *Artificial Inſtruments* in the *Table*,

Table, where ſometimes one Engin or Inſtrument may miniſter Aid to diſcover a large branch of Philoſophy, as the *Baroſcope*, an *Optick Glaſs*, &c.

And very particularly M. *Rook*'s directions for Seamen, which ſpecifies Inſtruments, may hereunto belong.

And ſometimes in one of the Diſcourſes herein mention'd, and abbreviated, there are almoſt as many Artificial Inventions, as Experiments; as in Mr. *Boyle*'s Hydroſtatical Experiments: Beſides all the Chymical Operations, recited in the *Treatiſe* of the *Origine of Forms*, &c.

Οὐκ ἐν τῷ μεγάλῳ τὸ εὖ, ἀλλ' ἐν τῷ εὖ τὸ μέγα.

ERRATA.

Pag. 392. lin. 23. blot out, *as.* ibid. lin. 24. read *of the Soul.*

FINIS.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn*, and *James Allestry*, Printers to the *Royal Society*: And are to be sold at their Shop without *Temple-Bar*, and in *Duck-lane*, 1667.

PHILOSOPHICAL Transactions:

GIVING SOME

ACCOMPT

OF THE

Present Undertakings, Studies, and Labours

OF THE

INGENIOUS

IN MANY

CONSIDERABLE PARTS

OF THE

WORLD.

VOL. II.

For *Anno* 1667.

In the *SAVOY*.

Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, Printer to the *Royal Society*.

To the Right Honourable

WILLIAM Lord VISCOUNT BROUNCKER,

CHANCELLOR to Her MAJESTY,

AND

PRESIDENT to the ROYAL SOCIETY, &c.

MY LORD,

After I had dedicated the First *Volume of these Philosophical Occurrences to the* R. Society, *to whose service I have dedicated* my self, *I thought it my next duty to present the* Second *to your Lordship, who have for so many years with so high and universal an Applause* presided *in that Illustrious Assembly, and there given full proof both of the vast extent of your knowledg, and the incomparable solidity of your judgment in all the various Arguments and Matters there produced, observed, experimented and discourſed of. This, my Lord, though it deserves a far better Pen to be proclaim'd to the world, then mine; yet did I think, I might be suffer'd in this crowd to cast in my voice, and to deliver the truth and my perswasion thereof in these plain expressions. To which I shall add no more but my humble acknowledgments for your Lordships particular favour and goodness, in condescending on all occasions, to encourage these (though rude and undigested) Communications, and thereby to fortifie (against the obloquies of some singular men) the endeavours of the Authour for the improving and enlarging his Philosophical Commerce; which, being done, may perhaps be a means to render these Papers less inconsiderable for the future.* I am,

My Lord,

Your Lordships

LONDON,
March 2. 1667/8

Very humble, and very much obliged Servant,

Henry Oldenburg.

Soc. Reg. Secr.

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FOR THE

PHILOSOPHICAL TRANSACTIONS.

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Hor-

Beginning the Third Year.

PHILOSOPHICAL TRANSACTIONS.

Monday, March 11. *1666.*

The Contents.

A Preface to the Third Year *of theſe* Tranſactions, *which is begun with this. An Account of the Enlargements of* Philoſophical Correſpondencies; *together with an Invitation to contribute Inquiries and Directions. Inquiries for ſeveral parts of the World, as* Suratte, *and the* Eaſt-Indies *in general; for* Perſia, *the* Weſt-Indies, *and there particularly, for* Virginia, Bermudas, Guaiana, Braſil. *Thoſe for other Countries referred to another opportunity. Of a conſiderable Load-ſtone, digged in* Devon-ſhire, *weighing* 60. *pounds. Some Obſervables about Load-ſtones, and Sea-Compaſſes. Propoſals to try the effects of the* Rarifying Engin *exhauſted, on Plants, Seeds, Eggs of Silk-worms. An Experiment propoſed of Grafting Pears upon* Spina Cervina (*Buckthorn.*) *Obſervations concerning* Emmets, *their Eggs, Production, Progreſs, Comming to Maturity, and Uſe. Account of a Book in* French, *intituled* HISTOIRE DES JOYAUX.

A PREFACE
To the Third Year *of theſe* Tracts.

HAving, by Gods Aſſiſtance, finiſh'd my ſolicitations for the *Philoſophical Tranſactions* of the *two laſt years*, I crave leave to reflect a little upon what hath paſt.

I think, I may ſafely aſſume, that in theſe *Fragments*, ſomething hath been contributed to ſowe ſuch ſeeds, as may ſomewhat conduce to the illuſtration and improvement of Philoſophy, and of all Laudable and Uſeful Arts and Practices. And

I hope, our Ingenious Correſpondents have examin'd all circumſtances of their communicated Relations, with all the care and diligence neceſſary to be uſed in ſuch Collections; not taking up old Fame, or flying Reports, upon too eaſie truſt; nor ſtraining for other Kinds of Wonders, than the moſt wiſe Author of Nature hath allowed, but attending cloſely to the ſtrict meaſures of *Natural Truth*, and to the uſeful Contrivances of *Art*. For ſome evidence whereof, I refer the *Reader* to the particulars, indicated in the *Tables* annexed to the *Tract* of *February*, lately paſt.

And becauſe well adviſed Hiſtories of *Natural Productions*, and of *Artificial Contrivances*, are neceſſary to beget ſound knowledge, and to *excite* profitable Inventions, ſome have furniſht us with accurate Inſtructions, under the *modeſt* Title of *Inquiries* and *Propoſals*: And further Diſquiſitions are by the hands of many Accompliſht Perſons ſeverally, and often with joynt endeavours in a manner univerſally proſecuted.

Neither have we diſcouraged or refuſed the Eſſays of ſome famous Philoſophers, learned Philologers and *Antiquaries*; whoſe Diſquiſitions, Readings, and Reaſonings, have extended farther than their Experiences; ſince by ſuch bold Excurſions and Sallies many valuable Truths may be ſtarted out of their receſſes. *Architects* do require ſome variety and ſtore of Materials for the further ſatisfaction of their Judgment in the Choice: And the *Sculptor* muſt pare off ſomewhat of his richeſt Marbles, Onixes, Diamonds, *&c.* before he can perfect the Portraicture Such liberty an exact Philoſopher muſt claim in his Extracts from Men of much Learning.

In *Medicinals* we have now and then occaſionally inquired after ſome rarities, medical applications and experiences; what the uſes and performances are by *Phlebotomy*, *Frictions*, Simples or Compounds not ordinary, by Diet or Chymical Operations in ſome of the remoteſt parts of the World, particularly in the famous *China*. Neither have we altogether omitted to commemorate thoſe obvious reliefs, which the Divine Bounty has offered freely and in common, for diſtreſſed Mortals, by *Springs*, *Baths*, *Bolus's*, *Medicated Earths*, *&c.* And we have had a due

See *N.* 3. *p.* 44. *Damps.*
N. 8. *p.* 133. Poyſonous ſprings or waters.
N. 8. *p.* 133. *Swarms of Inſects. Ibid. p.* 138. Strange Conſtitutions of Bodies.

due care to erect a *Pharos* for a Caution againſt undiſcern'd dangers.

By *Anatomy* we have ſometimes enter'd into the Chambers and Cabinets of *Animal* Functions, to find many Meanders and changeable Varieties, and the immediate Organs and Conduits of Life and Senſation.

As for the Growth of *Arts* and *Inventions*, I think, it may juſtly be ſaid. That theſe our Entries ſometimes aſſiſt and promote their Improvements. And the ſame will hereafter remain faithful Records to ſhew, By what ſteps and degrees, and by what Eſſays, Emulations, and Encouragements theſe Noble Arts advanced to perfection. And a punctual information of theſe Gradual Proceſſes, may be inſtructive to promote other Inventions. And the Wiſe will conſider it, at what eaſie rates they obtained *Monthly Advices* of the Deſigns and Succeſſes of Induſtrious and Eminent Perſons, and by the ſame means came to know as much, as was purchaſed at *their* great charges and aſſiduous labour. Of which Arts as they are now improved, and ſtill improving, I preſume I need not ſpare to ſay, That they would have obliged an *Alexander*, or a *Solomon*, and I muſt avouch with confidence, That they would have raiſed Acclamations, Applauſes, and Admiration of moſt, and have provoked them to refund full Rivers of Treaſures in Juſt Rewards, and extraordinary Atchievements.

Neither is it much amiſs, that there are yet ſome, who do prefer the darkneſs of old Heatheniſme before this Noon-light. Otherwiſe, the next Age might hardly believe, that Men pretending to Wit, Prudence, and Learning, would ever make ſuch ſtrange Oppoſitions againſt their own great Emolument and Accommodations: And ſo the Vertuous might be deprived of a *fair beam* of the future Glory, due to their Memories for their unchangeable Reſolutions, as unconcern'd in ſcoffing Diſcourſes, and ſtanding firm as Rocks againſt the daſhes of foaming Diſputants. And truly, they do much oblige us, in that they are pleaſed by their frets, and eager contentions, and by their fruitleſs and obſtreperous Verboſity, to make themſelves a foil, to ſet off the Serene Luſtre of the real and obliging performances of the Experimental Philoſophers.

And yet (in ſhort to convince and reclaim as many as are hopeful) I dare, *without leave*, but with ſincere affections, in behalf of the Learned *Virtuoſi*, undertake to joyn iſſue with them, and to offer fair proof, That, whereas they pretend to *Ariſtotle* as their *Grand Oracle*, we have a true and higher eſteem for his true worth, than theſe Pretenders do effectually manifeſt.

We ſay, his *Logicks* and *Rhetoricks* are very valuable. His *Ethicks* and *Politicks*, for the moſt part, ſound. His *Metaphyſicks* in many Notions acute. But all theſe are generally overwhelmed and degraded by the ſwarms of Inſectile Syſtemes and dilute Commentaries.

And as for the other more uſeful Volumes of *Ariſtotle*, his *Tracts* of *Animals* (which did coſt *Great Alexander* ſo many *Talents* for the furniture, and an ample Salary for encouragements) his *Mathematical Diſcourſes*, and *Mechanicks*, theſe they never ſalute. They weed out his onely defects and animoſities, his Velitations with his Elders and Compeers about Atomes and darker Principles; a *Matter*, which is *neque quid*, *neque quantum*, *neque quale*, a *Formal* and *Subſtantial* ἐντελέχεια (a word too hard for *Cicero* to tranſlate) and *Privation*, a *Principle* as good as the reſt; his Definitions of Cauſes and Affections; his *Quaternion* of groſſe *Element*s and groſſer *Mixtures*, and inſipid *Compoſitions* and *Qualities*, leſſe ſignificant than the popular Air: All of them much fitter to beget *Eternal* Controverſies, than to adminiſter any ſatisfaction to a reaſonable Underſtanding. Theſe they gather up for the ſweeteſt Poſies and faireſt Garlands, wherewith to adorn their Brows and Temples; and ſo they take their leave of *Ariſtotle* at the very Threſhold.

Thus they reject the Harmony, and waſte all their time in tuneing the Inſtrument, and are beſt pleaſed, even raviſh'd, with thoſe ſtrokes which glance below the Bridge, by which they ſharpen and turn their Spirits habitually, and ſet the teeth of their diſciples on edge; and then

Quo ſemel eſt imbuta recens, ſervabit, &c.

We take leave to ask, Whether *Ariſtotle* did not illuſtrate his beſt Conceptions in his Works, with *Mathematical* Demonſtrations? In this, *Blancanus* will initiate their Obſervations with ſufficient indulgence. We ask further, Which of the *Philoſophers*

of

of note, for any thing elſe but honeſt Moralities, did neglect the *Mathematicks?* What *free-born Child*, or yet what *Slave*, of any promiſing hopes, was not entered into theſe Diſciplines, before they could number ten years of their Age. If theſe men would addict their palats to the pure fountains, and not wander after every poluted ſtream, then they would find more leaſure for better things, to do ſome good for themſelves and others: Then they would taſte the pleaſure, and reap the profit of their old Rule,

Dulcius ex ipſe fonte, &c.

And withal they would have better underſtood their beſt friends.

Certainly; If *Ariſtotle* had been ſo happy, as to have enjoyed our *Opticks*, and other Inſtruments of Arts, and ſuch *Engins* as we now employ, He would have been quite of another ſpirit than theſe are; and would have acknowledged a greater variety and more curious contexture, and more briſk *Mechanicks* in the *Inſectiles*, which were in thoſe dayes *inviſible*, than in all the Animals, that were then known, or than are yet to be found in a far wider circumference; and would have confeſt the productions of our *Pyrotechnical Furnaces* to excell all, that could be reaſonably expected from his own vaſt *Fiery Region*.

We ſay heartily, Read *Ariſtotle*, read him in his own Stile; read him entirely and fully; not feeding onely on his Ulcers and Excreſcencies; nor taking up your reſt in his *Un-intelligible Heavens*, at their *Adamantine Gates*, or about their *Flaming Walls*: Embrace his calm rayes, and his diſ-intereſſed Reaſonings: chuſe his beſt Vertues, examine and weigh all his Mathematical Illuſtrations, deſcend to his particulars: And then haſten to our *Chriſtian* Philoſophers, and they will forth-with acquaint you with the true Works and wonderful Contrivances of the Supreme Author, and with the Diſcoveries, which by his indulgent Providence and his benigne Inſpirations have been in former and later Ages afforded, for the benefit, and the ſincerely grateful acknowledgements of humane race.

'Tis our main buſineſs, as well to retrive all *valuable Antiquities*, as to ſupply *freſh Diſcoveries*: to recover good *Old Helps*, as well as to deviſe *New*. All our Artificers are deſigned, and appropriated, to unlock all the Repoſitories of Nature, To draw out her moſt concealed Operations and Rarities, To produce them

with

with their beſt Advantages, and in their faireſt Ornaments, for all good occaſions: And whatever we find excellent in old *Greece*, or *Rome*, or in more ancient *Monarchies*, or in any one more happy part of the World, *That* in due ſeaſon to communicate all over the World, to as many, as have the Ingenuity to give them a hearty Entertainment.

After thus much of *Preface* (which the *Candid Reader* will interpret with the ſame affection, it was written) I return to my task. Where I think it not amiſs,

Firſt of all, to take notice of the late Enlargements of our *Philoſopical Correſpondencies* in both remote and neerer parts of the World; concerning which we are ſingularly obliged to ſeveral of the Generous and Intelligent Citizens of this Famous *Metropolis of England*, eſpecially the Eminent Governours of the *Eaſt-India* and *Turky* Companies, beſide thoſe of the ſame City, that travelling into the *Weſt-Indies*, have been very ready to receive, (and to promiſe good Accounts upon) ſuch *Philoſophical Inſtructions*, as were preſented to them concerning many particulars, thought worthy to be further inquired into, in our *American Colonies*. To which we ſhall add, what we have procured, for this our purpoſe, by our Commerce with *Spain*, *Portugal*, and *Barbary*; as well as by our Navigations into *Greenland* and *Iceland*: And alſo what occaſions we have before us, to enter into a conſociation with *Germany*, *Bohemia*, *Hungary*, *Tranſilvania*, *Carinthia*, *Tyroll*, and with all the principal Cities of *Italy*: it appearing already by our former Papers, what intereſt we have, before now, eſtabliſht in *France*, and, by the aſſiſtance of the Eminent *Hevelius*, in all the Countries upon the *Baltick Sea*, and in *Poland*; which is therefore related here, that we may thence take occaſion to invite all Ingenious Men, and ſuch as conſider the importance of Cementing Philoſophical Spirits, and of aſſembling together Ingenuities, Obſervations, Experiments and Inventions, ſcattered up and down in the World; that they would be pleaſed *partly* to recommend themſelves, as they have occaſion, theſe Kinds of Inquiries to their Ingenious Acquaintance, either living upon, or travelling into ſuch places, as are concerned; *partly* to joyn their *Symbola's*, and to ſend in their *Propoſals*, and whatever ſhall occur to them worthy to deſire information about, in thoſe Countries

tries above-mention'd; and reſt perſwaded, that all poſſible endeavours ſhall be employed on our parts, to recommend all, what ſhall thus be propoſed by them, to *Our* Correſpondents, with the ſame earneſtneſs we do our own Directions, ſuggeſted by ſeveral of our Curious Friends.

Inquiries for Suratte,

and other parts of the Eaſt-Indies.

THough theſe Quæries have been already diſpatcht for India, *and ſome of them even received an Anſwer, yet, becauſe 'tis altogether neceſſary, to have confirmations of the truth of theſe things from ſeveral hands, before they be relyed on, it was thought fit, rather to publiſh the* Inquiries *alone, for a more certain and full Information, than now to joyn* ſuch Anſwers *thereunto.*

The *Inquiries* are theſe; as the Relations publiſht by *Purchas*, *Linſchoten*, and others, concerning thoſe parts, have given occaſion to propoſe them.

1. Whether it be true, that Diamonds and other Pretious Stones, do grow again after three or four years, in the ſame places where they have been digg'd out?

2. Whether the Quarries of Stone near *Fettipore*, not far from *Agra*, in the *Mogol*'s Dominions, may be cleft like Loggs, and ſawn like Planks, to ceel Chambers and cover Houſes therewith? Likewiſe, Whether about *Sadrapatan*, on the Coaſt of *Coromandel*, there be a Stone of the like nature, ſo as, ſetting a Wedge upon it, one may cleave it with a Mallet as thick and as thin, as one pleaſeth?

3. Whether upon the ſame Coaſt of *Coromandel*, about *Tutucorin*; and upon that of *Ceylon*, at *Manar*, and *Jafanapatan*, they fiſh *Pearls*, as good as thoſe about *Ormus*? Whether thoſe Pearls are the better, the deeper they lie? What is the greateſt depth, they are known to have been taken at? And whether it be true, that ſome of the Natives there, can ſtay under Water half an hour, without any Art?

4. Whether the Iron in *Pegu* and *Japan*, be far better than ours; and if ſo, what is to be obſerved in the melting, forging, and tempering of it?

5. Whether

5. Whether in *Sumatra* there be a fountain, running a very Sanative Oyl? And whether the ignivomous Mountain in the ſame Iſland, do burn continually, and caſt out ſtones ſo eaten out by the fire, that they ſwim?

6. What is the Opinion of the more Inquiſitive Men in thoſe parts, of *Amber-gris*? And whether the greateſt quantities and maſſes of it are found about the Iſle *Mauritius*?

7. Whether it be Winter on the Eaſt-ſide of the Mountain *Gates*, which comes from the North to Cape *Comorin*, whil'ſt it is Summer on the Weſt-ſide, and ſo, *vice verſa*?

8. Whether it be true, that upon the Coaſt of *Coromandel*, 16 deg. Northern Latitude, between *Paleacote* and *Maſelupatan*, 50. Leagues in length (the hot winds blowing from the Land-ward from 8. in the Morning, till 4. in the Afternoon, with ſuch a ſuffocating heat, that the Inhabitants are not able to endure it, without extraordinary helps and refreſhments;) every one daily for his proviſion of drink, hangs his Bottle, made of common pot-earth, and filled with Well-water, or other potable Liquor, upon ſome Poſt, Tree, or Wall, in places, where the Sun and Wind are moſt piercing; leaving it there all the day long in the ſcorching heat; and then taking it up about Evening at 4. of the Clock, the Drink is more cool, than any depth of Cellerage with us can make it? And whether, on the contrary, the Bottles being ſuffered to continue in the Air, as before, during the cool Sea-gales, which come in after the ſaid hour, and continue all Night, till 8. in the Morning, to the refreſhment of all Creatures, the Liquors grow hot and unfit for drink?

9. Whether the *Tyde* near *Mindanao*, going from the *Molucca*'s to the *Philippina's*, are ſo ſwift, that neither contrary Winds nor Anchors, can ſave a Ship from being carried away by it; and that it riſes but about 3. or 4. feet? And whether the like be obſerved in the Bay of *Cambaja*, and in that between *Martaban* and *Pegu*? And particularly, Whether in the ſaid *Bayes*, the Tides come in with that impetuoſity and ſwiftneſs about the *Quarters* of the *Moon*, that the Watch-men from high Towers muſt with their Trumpets give warning to the people to retire; and that a Horſe in his ſwifteſt courſe, when ſuch a Tide comes upon him, cannot out-run it: as *Iſaac Voſsius* obſerves, Lib. *De Motu Marium*

Marium & Ventorum. c. 15. And what other particulars are observable upon all those Coasts, concerning the Tydes?

10. Whether there be any Discoveries newer, than the newest printed Maps, of the parts of the World *North-east* of *Japan*? And whether *Japan* be truly an Island, or no?

11. What is the true way of making and colouring *China-Dishes*; and how in *China* and *Japan*, they make the *Black-vernish*?

12. With what Materials, and how they paint both upon Cloths, commonly call'd *Pintado's*, and likewise upon Canvas, *&c*?

13. Whether the *Lignum Aloes* be the Wood, or Root of a Tree? In what Country it is found? And how to know the best of the kind?

14. Whether the best *Tea* be that, which comes forth at the first of the Spring, and are the Top-leaves? In what manner 'tis dried; and whether the too hasty drying thereof hurts it?

15. Whether there grows a Wood in *Java*, that naturally smells like humane Excrement? And if so, what kind of ground it grows in?

16. Whether in the *Molucque* Islands there be a *Red Wood*, which burns, sparkles, and flames, without being consumed; yet may be reduced to powder, by rubbing between ones fingers?

17. Whether near the Fort of *Ternate* there be a Plant, call'd by the Inhabitants *Catopa*, whence fall little Leaves, which are turned into Butter-flies?

18. Whether in *Pegu*, and other places of the *East-Indies*, they use a poyson, that kills by smelling, and yet the poisonous smell is hardly perceived?

19. Whether it be true, that the onely Antidote hitherto known, against the famous and fatal *Macassar*-poyson, is *humane Ordure*, taken inwardly? And what substance that poyson is made of?

20. Whether there be such a Vegetable in *Java*, call'd *Mangas bravas*, that is so poisonous, that it kills presently, and for which no remedy hath been yet found?

21. Where the best *Calamba-wood*, or *Palo d' Aquila*, grows? VVhether the *Palo d' Aquila* be much inferiour to *Calamba*; and

how they are diſtinguiſht? Whether the later be the *Pith* of the former? Whence the beſt ſort comes? Whether it be ſtored with a rich and cordial Balme, and that be the cauſe of its great rate, being much uſed in caſes of decay of Spirits, and the lameneſs and impotency of Nerves?

22. Whether they draw an *Oyl*, reſembling Oyl of *Camphire*, from the Roots of *Cinamon*-trees; and if ſo, how they draw it?

23. Whether the Camphire of *Borneo* be not the Exſudation or Gum of a Tree?

24. Whether the *Indians* can ſo prepare that ſtupifying Herb, call'd *Dutroa* or *Datura*, that they make it lie ſeveral Dayes, Moneths, and Years, according as they deſign it, in a Mans Body, without doing him any hurt, and at the end kill him, without miſſing an hours time?

25. Whether the *Betele* hath ſuch a contrariety to the *Durion*, that a few leaves of that, put to a whole Shop-full of *Durions*, will make them all rot ſuddenly? And whether thoſe, that have ſurfetted on *Durions*, and thereby over-heated themſelves, do, by laying a leaf or two of *Betele* upon their Breaſts or Stomachs, immediately cure the Inflamations, and recover?

26. Whether the *Papayas*, which bear fruit like a Melon, do not bear, unleſs Male and Female (as the Vulgar diſtinguiſhes them) ſtand together?

27. Whether there be two ſorts of the Tree, call'd *Arbor Triſte*, one, by the Name of *Triſte di Die*, the other, *Triſte di Notte*; whereof the former ſheds his flowers at the Riſing, the other, at the Setting of the Sun? And whether the diſtilled water thereof (call'd *Aqua di Mogli* by the Portugals) may not be tranſported into theſe parts?

28. Whether one of thoſe Trees, call'd *Arbre de Rays*, propagates it ſelf into a whole Forreſt, by ſhooting up, and letting fall Roots from all its branches into the ground, that ſpring up again, and ſo on? And whether there be any ſingle ones of theſe Trees, that are above 50. feet in Diameter, as ſome affirm?

29. What particulars are obſervable in any other Plants of thoſe parts?

30. Whe-

30. Whether thoſe *Shell-fiſhes*, that are in *theſe parts* plump and in ſeaſon at the *Full Moon*, and lean and out of ſeaſon at the *New*, are found to have contrary Conſtitutions in the *Eaſt-Indies*?

31. Whether the Animal, that yields the true *Muske*, be like a *Dear*, hornleſs, found in the High-Countrey between *Pegu* and *China*? And whether the *Muske* grows in Baggs, Bliſters, or Swellings, which the Beaſt rubs off againſt Trees; it being affirmed to have been found in the Woods by the Scent? Whether true Muske, is diſcerned from falſe by its yellowneſs, when rubb'd upon ones hand, and by its keeping that Colour and the Scent?

32. Whether there be two ſorts of *Gum-lack*, one produced by an Inſect, a certain winged Ant; the other, the Exſudation of a Tree?

33. To inquire after the Fiſh call'd *Caballa*, ſaid to be very powerful in ſtanching of blood?

34. Whether about *Java* there be Oyſters, or other Shell-fiſhes, of that vaſt bigneſs, as to weigh 300. pounds?

35. Whether in *Malacca* there grows ſometimes a ſtone in the ſtomack of a kind of *Porcupine*, call'd *Pedro Porco*, eſteemed for its Cordial Vertue above *Bezoar*?

36. Whether there be found in the head of a certain Snake, a Stone, which laid upon a wound of any Venemous Creature, ſticks faſt to it, and draws away all the poyſon; then being put in Milk, voids its poiſon, and turns the Milk blew; and then applied again, draws out the reſt of the poiſon, that may be behind, till the wound be perfectly cleanſed?

37. Whether the *Rhinoceros* have ſuch an Antipathy againſt Elephants, as is commonly related?

38. Whether in the Iſland of St. *Helena*, the Tide be at the ſame time round in the ſeveral Coaſts of it; and what is the hour of Full Sea, and what the age of the Moon at the time of Obſervation?

Inquiries for Perſia.

1. WHat are chiefly the preſent Studies of the *Perſians*; and what Kind of Learning they now excell in?

2. What other Trades or Practices, beſides *Silk*-and *Tapiſtry*-making, they are skilled in?

3. VVhether, there being already good Deſcriptions in *Words* of the Excellent Pictures and Baſſe Relieves, that are about *Perſepolis* at *Chimilnar*, yet none very particular; ſome may not be found ſufficiently skill'd, in thoſe parts, that might be engaged to make a Draught of the Place, and the Stories there pictured and carved?

4. How they make that Plaiſter, wherewith in thoſe parts and in *India* they line their *Tanks* or *Ciſterns*, and which, when dry, ſhines like Marble, and is much harder?

Other *Quæries*, concerning the Air, VVaters, Minerals, Vegetables, Animals, *&c.* peculiar to *Perſia*, may be taken out of thoſe *General Heads* of Inquiries, *for a Natural Hiſtory of a Countrey*, printed in *Numb.* 11. and out of thoſe *Articles* of *Inquiries concerning Mines*, publiſht in *Numb.* 19. to which we refer the *Reader*.

As to the Inquiries proper for Turkey, *they alſo are already publick.* See *Numb.* 20.

Inquiries
For Virginia *and the* Bermudas.

1. COncerning the Varieties of *Earths*; 'tis ſaid, there is one kind of a *Gummy* conſiſtence, white and cleer: Another, white, and ſo light, that it ſwims upon water: Another, red, call'd *Wapergh*, like *Terra Sigillata*. Quære, what other conſiderable kinds are there? And to ſend over a parcel of each.

2. VVhat conſiderable Minerals, Stones, Bitumens, Tinctures, Drugs?

3. VVhat hot Baths, and of what Medicinal uſe?

4. VVhat is the Original of thoſe large Navigable Rivers, which

which empty themſelves into the Bay of *Cheſapeak*? And whether on the other ſide of that ridge of Mountains, from which they are ſuppoſed to proceed, there be not other Rivers, that flow into the *South-Sea*?

5. How the Silk-graſſe is prepared?

6. To give a full account of that Vulnerary Root, called *Wichacan*: Of *Pocone*, a Root of a red juyce, a good tincture: Of *Muſquaſpenn*, a Root of a red tincture: Of the Plant *Maricock*, whoſe fruit is ſaid to be faſhion'd like a *Lemmon*, exceeding pleaſant to the taſte; of a bloſſom moſt beautiful: Of the *Chincomen*-Tree, whoſe fruit is ſaid to have a huske like a *Cheſnut*, luſcious and hearty meat, both raw and boiled.

7. Whether there be in the *Bermudas* a Poiſon-weed, like our *Ivy*, whoſe leaves do by the touch cauſe Bliſters? And a Reed, whoſe juyce or infuſion cauſeth Vomit?

8. What kind of Trees thoſe Barkes are taken from, that are uſed inſtead of Tile or Slate in the covering of their Houſes, being cooler in Summer and warmer in Winter, than Stone?

9. To give a particular account of the Spider in the *Bermudas*, ſaid to be large and beautiful for its colours; weaving a Web betwixt ſeveral Trees, which is affirmed to be for ſubſtance and colour like perfect raw Silk; ſo ſtrong, that Birds, like Snites, are ſnared therein?

10. Whether Deer have there generally three or four Fawnes at a brood? And whether any of the Cattle tranſported from hence, becomes there more fruitful, than they were here?

11. Whether the Relation be true, of a *Glue* made of Harts-Horn, that will not diſſolve in Water; and if ſo, how made?

12. Whether at the bottom of the Bay of *Cheaſapeak* Northward, the Natives be ſtill of ſuch a *Gigantick* Stature, as has been reported? And, whether there be another people, not far from theſe, Eaſtwardly, of a *Dwarfiſh* Stature?

13. Whether round about the Coaſt of the *Bermudas*, the *Tydes* keep the ſame time; and at what a clock preciſely 'tis *High-water* on the Dayes of *Full* and *New* Moon; and how high the Water riſes then? And the like on the Coaſts of *Virginia* and *Florida*?

For

For Guaiana *and* Brasil.

1. WHether about *Urraba* near *Oronoque*, some 8. degrees Northern Latitude, and about the Town *Darien*, Toads are presently produced, by throwing a kind of Mooriſh Water found there, upon the Floors of their Houſes? *Linſchoten.*

2. Whether it be true, that the Locuſt of *Braſil*, call'd *Caayara*, changeth in the Spring-time of that Countrey into a Plant, and withers away, like a Plant? And whether in the ſame Countrey, that kind of *Eruca*, call'd by the Portugals *Lagartas des Verias*, turns into a Bird, admirable for Colour and ſwift flying; the change thereof being made ſo leaſurely, that one may for a while ſee half of the Inſect, and the other half of the Bird, which the Natives call *Guainumbi*, the Portugals *Pegafrel. Piſo.*

3. Whether upon the Leaves of that *Braſilian* Tree, call'd *Cereiba*, there is, in a Sun-ſhiny day, found a *White Salt* in that quantity, that one may gather as much from two or three Leaves, as will well ſalt a good pot of Broth? *Piſo.*

4. Whether there be found about the mouth of the River of *Amazons*, a *green Argilla*, which, though very ſoft under water, yet, when expoſed to the Air, grows almoſt as hard as a Diamond; in ſo much that the Natives make *Hatchets* of them, ſtrong and ſharp enough to cleave Wood; for which purpoſe alſo thoſe *Indians* are ſaid to have uſed it, before they got Iron-ones? And, whether this *Argilla*, become Stone, have a peculiar vertue againſt the *Epilepſy*, when carried by the Patient? *Pelleprat* in his Relation of the *Iſlands* and *Terra-firma* of the *Southern America.*

5. Whether the *Black Bees* in *Guaiana*, about the River *Orenoque*, make black Honey and Waxe? And whether they have no Stings, as the ſame *Pelleprat* affirmeth?

The other Inquiries, ready for the other Countries above-named, are, to avoid tediouſneſs, referred to another opportunity.

post. num. 25. p. 467, 468, 9. 470, 1, 2.

for the Caribbee Islands nu: 33. pa: 634, 5, 6, 7, 8, 9.

Of

Of a conſiderable Load-ſtone digged out of the Ground in Devonſhire.

THis Stone was lately ſent up out of the ſaid County, and preſented to the *R. Society* by the Reverend Arch-deacon, Doctor *Edw. Cotton*, with this deſcription, That it weighs 60 pounds; and that, though it take up no great weight, yet it moves a Needle about nine Foot diſtant. Some part of it being broken off, he hath ſent up alſo, becauſe (*ſaith he*) being put in its proper place, it adds much ſtrength to it, but without that addition it moves not much more than ſeven Foot.

Care will be had, that Tryals be made of the Vertue of this Stone, both of the two pieces cloſed together, and of each piece ſeparately, and that uncapped as well as capped.

Some Obſervables about Load-ſtones, and Sea-Compaſſes.

A Noble Perſon did upon a late occaſion, affirm, That a Needle of a Sea-Compaſs, put in a good Iron Mine (which, *he ſaid*, yeilded 23 pounds of Metal, out of 120 pounds of Ore) was not ſenſibly moved thereby.

Another Honourable Perſon deſired, it might be obſerved, whether touched Needles move otherwiſe, when the Veins of Iron do not lie *North* and *South*, then when they do ſo?

It being inquired by a *Note* from forreign parts, Whether the Sea-Compaſſes in *England* were brought to a greater perfection, than in other *Countries?* Anſwer was made by intelligent perſons here, That all the perfection of our Sea-Compaſſes, as yet, conſiſted in this, That the Needles be touched by good Load-ſtones, and well librated, and that the Variation be truly placed: Though it was ſuggeſted withal, that for the greater perfection of ſuch Sea-Compaſſes, a way was contriving, to ſhew the Variation to *Minutes* and *Seconds*.

It was alſo propos'd, That it might be inquired into,

1. Whether a *Needle* may be ſo toucht upon any Magnet, as not to point to the true *North* and *South*, to be tried in ſuch places where there is no Variation known? *Anſw: N. 26. p. 478.*

2. Whether

2. Whether different Load-ſtones will give different Directions? And whether fainter or ſtronger touches upon one and the ſame Magnet, will cauſe any Variation in the Directions? For which purpoſe, as many Load-ſtones ſhould be procured, as could be had, and a good number of Needles exactly made, of the ſame Metal, bigneſs, and figure?

PROPOSALS

To try the Effects of the Pneumatick Engine *exhauſted, in Plants, Seeds, Eggs of Silkworms.*

The Ingenious Dr. *Beale* did formerly ſuggeſt, as follows. It would be, I think (*ſaith he*) very well worth the tryal, to ſee what Effects would be produced on Plants, put into the Pneumatick (or Rarifying) Engine of Mr. *Boyle*, with the Earth about their Roots, and flouriſhing; whether they would not ſuddenly wither, if the Air were totally taken from them. And particularly to try in the Seaſon, *Cherry-Bloſſoms*, when partly opened, partly not opened, upon a Branch; to wit, whether the Air may be ſo attenuated as to blaſt. But it may be noted, that the Bloſſoms do not forthwith diſcover the blaſt: An old experienced Country-man having once given me notice of a blaſty Noon, (it being then a Sultry weather, and ſomewhat gloomy with the thickneſs of Exhalations, almoſt like a very thick Miſt) and within a day or two ſhewing the proof upon the Cherry-Bloſſoms then flagging, but not much altering their Colour till two days more were paſt.

The Noble Mr. Boyle *ſuggeſts as proper for the approaching Seaſon*; That it may be tried,

1. Whether Seeds (eſpecially ſuch as are of a haſty growth, *vid. Orpin, Lettice, Garden-creſs-ſeeds, &c.*) will germinate and thrive in the exhauſted Receiver of the ſaid *Engine*?

2. Whether the Excluſion of Air from the *Senſitive* Plant, would be harmful to it?

3. Whether the Grafting of Pears upon *Spina Cervina* (the almoſt only *Purgative* Vegetable known in *England*) will produce the effect of communicating to the Fruit that purging quality, or not?

4. Whether *Silkworms Eggs* will be hatched in ſuch an exhauſted Receiver, in the Seaſon proper for hatching?

To

To which may be added, the Trials of putting in a Vial full of water, some of those Herbs that will shoot and grow in water alone, including them in such a Receiver, and pumping out what Air you can, to see whether they will then shoot, or not?

And though some of these *Propoſals* have been formerly begun to be Experimented, yet ought they to be diligently prosecuted, to see how far the Air is necessary to Vegetation; and whether Plants do indeed live as much upon the Air, as the Earth; and the Branches of them are rooted (as it were) *in* and quickned *by* the Air, as their Roots are planted and nourisht in and by the Earth?

The Experiment heretofore made of this kinde, was, That some Lettice-seed being sown upon some Earth in the open Air; and some of the same Seed at the same time upon other Earth in a Glass-Receiver of the above mention'd Engine, afterwards exhausted of Air; the Seed exposed to the Air was grown up an inch and a half high, within eight days; but that in the exhausted Receiver, not at all. And, Air being again admitted into the said emptied Receiver, to see whether any of the Seed would then come up; it was found, that in the space of one week it was grown up to the height of two or three Inches.

OBSERVATIONS

Concerning *Emmets* or *Ants*, their Eggs, Production, Progress, coming to Maturity, Use, *&c.*

This was communicated by Doctor Edmund King, *Fellow of the R. Society, at the Instance of the Publisher, as followeth.*

1. THere have occurr'd to my Observation but three sorts of *Ants*, commonly without Wings; *vid.* Very *Black*, *Dark Brown*, and the third sort of near the colour usually call'd *Philemort.*

2. Each kind inhabit by themselves in their several Banks; two sorts seldom or never being found together; and if either of the other two sorts be put into the black Ants Bank, 'tis worth observing, what enmity there is betwixt these little Creatures, and with what violence the *Black* ones will seize on the *Red*, never leaving to pinch them on the head with their *Forceps* or Claws, till they have kill'd them upon the place: which done, they will car-

ry them dead out of the Field, from their Bank. But if you put *Black* Ants into a Bank of the *Red*, the Black ſeem to be ſo ſenſible of the ſtrangeneſs of the place they are in, that there they will not meddle with the Red, but as if they were frighted, and concerned for nothing but ſelf-preſervation, run away.

3. Upon opening of theſe Banks, I obſerve firſt a *white ſubſtance*, which to the bare eye looks like the ſcatterings of fine white Sugar or Salt, but very ſoft and tender; and if you take a bit of it, as big perhaps as a Muſtard-ſeed, and lay it on the Object-plate of a good *Microſcope*, you may by opening it with the point of a Needle, diſcern many pure, white and clear appearances in diſtinct Membrans, all figur'd like the leſſer ſort of Birds Eggs, and as clear as a Fiſhes Bladder. This ſame ſubſtance as it hath been juſt now deſcribed, I finde in the Ants themſelves, which I take to be the true *Ants Eggs*; it being obvious to obſervation, that where ever this is uncover'd, they make it their buſineſs to carry it away in their mouths to ſecure it, and will after you have ſcatter'd it, lay it on a heap again with what ſpeed they can.

4. I obſerve they lie in multitudes upon this (if I may ſo call it) Spawn of theirs; and after a little time, every one of theſe ſmall adherances is turn'd into a little Vermicle, as ſmall as a Mite, hardly diſcerned to ſtir; but after a few days more, you may perceive a feeble motion of flexion and extenſion, and they begin to look yellowiſh and hairy, ſhaped very like a ſmall Maggot; and ſo, keeping that ſhape, grow almoſt as big as an Ant, and have every one a black ſpot on them.

5. Then they get a *Film* over them, whitiſh, and of an Oval ſhape, for which reaſon I ſuppoſe they are commonly call'd *Ants Eggs*, which yet (to ſpeak properly) they are not.

6. I have, to prevent miſtakes, opened many of theſe vulgarly call'd *Ants Eggs*, I mean, the leſſer ſort, (for there are ſome as big as a Wheat-corn, others leſs then a Rye-corn) and in *ſome* I finde onely a Maggot, to appearance juſt ſuch as was deſcribed before: In *others*, I finde a Maggot beginning to put on the ſhape of an Ant about the head, with two little yellowy ſpecks where the Eyes are deſign'd: In *others*, a further progreſs, and furniſht with every thing to compleat the ſhape of an Ant, but wholly tranſparent, the Eyes onely excepted, which are then as black as black Bugles.

7. But

7. But when they have newly put on this ſhape, I could never diſcern the leaſt motion in any one part of the little Creature, whereof the reaſon may perhaps be, the weakneſs of their Fibres; for after a little more time, when they begin to be browniſh, they have ſtrength to ſtir all their parts.

8. At laſt I met with ſome of theſe reputed Eggs, which being carefully open'd by me, I took out of ſeveral of them, every way perfect and compleat Ants, which did immediately creep about among the reſt, no way differing from many other Ants, but by a more feeble motion of their Limbs. And this I took for a clear demonſtration of what I deſigned, which was to know, That the Film does onely cover the Maggot, while ſhe is transforming into an Ant, and fit to ſhift for her ſelf.

9. The *black Speck* that is at one end of every ſuch reputed Ants Egg, I ſuppoſe to be caſt out of the Maggot in her transformation; ſince, after it puts on the ſhape of an Ant, the Speck is quite gone, and the whole body of the Ant pure clear; ſince alſo this Speck at the end of the ſaid Egg, lies always cloſe to the *Anus* of the included Ant.

10. As to their care for their *Young* (by which I mean all the ſorts and degrees aforeſaid, from the Spawn to the vulgarly call'd Eggs, in every one of which you'l finde a young Ant) it is obſervable, How upon the breaking up of their Banks, they make it their buſineſs immediately to carry their Young out of ſight again, laying the ſeveral ſorts of them in ſeveral places and heaps: the which if you mingle again or ſcatter, you ſhall, laying but ſome bits of Slate, or the like, in any place they may come to and get under, after a few hours ſee all the Vermicles, and vulgarly call'd Eggs, laid in their ſeveral and diſtinct parcels, under ſuch pieces of Slate, *&c.* Provided the place be not ſo cold as to chill their Limbs; which if it be, by being brought to the fire they will ſoon recover their ſtrength, and fall to their buſineſs again, of ſecuring their little Ones.

11. I have obſerved in Summer, That in the Morning they bring up thoſe of their Young (that are vulgarly call'd Ants Eggs) towards the top of the Bank; ſo that you may from Ten in the Morning, until Five or Six Afternoon, finde them near the top; eſpecially about One, Two, or Three of the Clock, and later, if the Weather

be hot, when for the moſt part they are found on the South-ſide of the Bank: that towards Seven or Eight at Night, if it be cool, or likely to rain, you may dig a foot deep before you can finde them.

They know all the ſorts of their Young ſo well, that you cannot deceive them, though you may with fine Sugar, Salt, or the Crums of very white ſtale Bread, ſcatter'd in the Mould, where their firſt true Eggs are (as I call them) be miſtaken your ſelf, yet the Ants will not, nor touch a bit of what is not their own Off-ſpring.

13. I cannot paſs by the *Uſe* of *Ants* in feeding young Pheaſants and Partridges, they being the principal Food of theſe Birds, both wilde and tamed, for ſeveral weeks, as is well known to all that are verſed in breeding them up. And a chief reaſon, why many finde it ſo nice a thing to breed up the ſaid Birds, is, that either they give them too ſparingly of this Food, or let them faſt too long, not knowing, that as ſoon 'tis day-light, they will ſeek it for their Breakfaſt, and if they want it, will in a few hours be faint and weak, and ſome grow ſo chill for want of that ſupply of Nouriſhment, that it is no eaſie matter to recover them.

14. But (to add this by the by) Though theſe Inſects be ſo good a Food to theſe Birds, whileſt very young; yet when by ill ordering of thoſe that ſhould keep them ſweet, and often ſhift their water, or by ill Dyet, as muſty Corn, *&c.* they grow ſick; then Ants will not always recover them, though you give them never ſo many: And I have been forced to make uſe of other Inſects to cure them, to wit of *Millepedes* and *Earwigs*, either of which will do good, but both together, better; given in a good quantity, two or three times, at leaſt, a day; but then thoſe other things muſt be obſerved too, of keeping their Houſe clean, and giving them ſweet Corn, and ſhifting their water twice a day, keeping them within, till the Dew be from the ground, letting them bask in Sand, partly in the Sun, the place a little ſhaded, and putting them up in a warm houſe before Sun-ſet.

Which particular I thought not amiſs to add for thoſe that delight in breeding up *Pheaſants* and *Partridges*, my ſelf having loſt many of both ſorts, till I learned that Vertue of thoſe Inſects; after which, ſeldom any of them, by me intended to be bred up, have died.

An

An Account
Of a ſmall Book in French, *entituled*
HISTOIRE DES JOYAUX.
ET
Des Principales Richeſſes de l' Orient *et de l'* Occident, *par le Sr.* Chapuzeau.

THis Hiſtory treats of Diamonds, Rubies, Emeraulds, Pearls, Coral, Bezoar, Yellow Amber, Amber-gris, Indigo, *&c.*

Of *Diamonds*, The Author ſhews:

1. The *Places*, whence they are taken; of which he finds but Five in all the *Eaſt-Indies*, whereof *two* are *Rivers*, vid. *Saccadan* in *Borneo*, and *Nage* in the Kingdom of *Bengala*; at the bottom of both which, *he ſaith*, the Diamonds are found among the ſand, after the waters, that fall as great Torrents from the Mountains, are run off; and the three others are *Mines*, in the Kingdoms of *Decan*, *Cuncan*, and *Golconda*. In this Relation he obſerves, that the Diamonds which are found at the bottom of thoſe Rivers, have the beſt *Water*; but thoſe, in Mines, have often *Flaws* (which he imputes to the violent knockings of the Rock) and *Blebs*, aſcribed to the condition of the Earth or Sand they are found in, *vid.* when that is not pure, but fattiſh or black. He takes alſo notice, that Diamonds are the heavieſt of precious Stones, as Gold is of Mettals.

2. The *Manner*, how they are found and ſeparated; which is the ſame in ſubſtance, with that, deſcribed *Num* 18. *p.* 328.

3. The *Price* of them, according to the proportion of their weight; for which he gives this Rule. Take, ſaith he, a Diamond of 10 *Carats*: this number is to be ſquared (which makes 100.) then, if the Stone be clean, each Carat according to its perfection, may be worth 40 to 60 Crowns; if it have no good water, or have a Bleb or Flaw, the Carat will not be worth but from 10 to 30 Crowns. So multiplying the ſaid 100 by the number, which each Carat of ſuch or ſuch a Stone may be worth, the product is the price of the Stone.

For

For *Rubies*, he diſcourſes alſo of the *Places*, where *they* are found; and of their *Price*. The *Places*, are, the Kingdom of *Pegu*, and the Iſle of *Ceylon*; whence very few are ſuffered to be carried away. The *Price* is, that a good *Rubi* of the weight of 1 *Rati* (which is $\frac{7}{8}$ of a *Carat*) is eſteemed at 20 old *Pagodes* in *India*, each *Pagode* being about 10 ſhillings *Engliſh*.

Ratis.		*Pagodes.*
Of 2	is valued at	100.
Of 3	——	250.
Of 4	——	500.
Of 5	——	900.
Of 6	——	1500.
Of 7	——	2300.
Of 12	——	12000.

Concerning *Turquois*, they are found in *Perſia*, in the Province of *Chamaquay*, North of *Iſpahan*, in two Mines, called the *Old* and the *New* Rock. Theſe of the *New*, are of an ill whitiſh Blew; but thoſe of the *Old*, are not ſuffered to be digged out, but by the King of *Perſia* himſelf.

Emeraulds are affirm'd by him, never to be found in the *Eaſt-Indies*, but in *Perou*, whence they were carried by that Trading People to the *Moluccas*, even before *America* was diſcovered by the *Europeans*; and ſo they come from the Orient; of much leſs value, than they were formerly, by reaſon of their commonneſs. The Author notes, that *Emeraulds* grow in ſtones, juſt as Chryſtals, forming a Vein, in which they are by little and little refined and thickned: and that ſome of them are ſeen, half white and half green; others, all white; and others all green and perfect.

To *Pearls* he aſſigns in the *Orient*, four places, where they are fiſhed: The Iſle of *Baharem* in the *Perſian Gulf*: The Coaſt of *Arabia Felix*, near the Town of *Catif*, over againſt *Baharem*: The Iſle of *Ceylon* about *Manar*: The Iſle of *Japan*. The beſt at *Ceylon*, but ſmall; the biggeſt at *Japan*, but uneven. In the *Weſt-Indies* they are fiſh'd in the *North-Sea*, in the Iſles of *Marguerite*, *Cubagva*, St. *Marthe*; and at *Comana*, and *Comanagote*, near the Continent; and in the *South-Sea*, near *Panama*: which

American

American ſort, though they are much inferiour to the *Oriental*, in Luſtre, yet they far excel them in bigneſs, amounting ſometimes (ſaith this *Author*) to 42 *Carats*.

In this Relation 'tis mention'd, that ſometimes 5. or 6. *Pearls* are found in one Oyſter: That *Pearl-fiſhers* are fed with dry and roaſted meat, to give them better breathing: That Pearl-bearing Oyſters are not good to eat, being flat and hard of digeſtion, *&c.*

As to the *Price* of good *Pearls*, well faſhiond, he marketh it, as follows:

Such a Pearl of

Grain.	*Crowns.*
1	1
2	4
3	9
Carats.	
1	16
1 1/4	25
1 1/2	36
1 3/4	49
2	64
2 1/4	81
2 1/2	100
2 3/4	121
3	144
3 1/4	160
3 1/2	196
3 3/4	225
4	256

Carats.	*Crowns.*
4 1/4	289
4 1/2	324
4 3/4	361
5	400
5 1/4	441
5 1/2	484
5 3/4	529
6	576
6 1/4	625
6 1/2	675
6 3/4	729
7	784
7 1/4	841
7 1/2	900
7 3/4	960
8	1024

Of *Corals*, He taketh notice, *where* they are fiſhed, and *in what manner*. The *Places*, *he ſaith*, to be *Eight*; *Three* upon the Coaſts

Coasts of *Corsica* and *Sardinia*, *vid.* at *Argueil* (where is the best) *Baza*, and near the *Isle of St. Peter*: *One* upon the Coast of *Sicily*, near *Drepanum*: *Two* upon the Coast of *Africa*, near the *Bastion of France*, and at *Tabarca*: *One* more, upon the Coast of *Catalonia*, at the *Cape* of *Quiers*: And the last, about *Majorca*. Observing, that red Coral is not found, but in the *Mediteranean* alone, where 'tis fished from the beginning of *April*, till the end of *July*, employing commonly about 200 Boats. The *manner* of fishing them, is with two big beams of wood, laid cross wise, with a good piece of Lead on the middle, to make it sink, casting about it course Hemp, carelesly twisted, and tying this Wood to two Ropes, whereof one hangs at the Sterne, the other at the fore-part of the Boat; and so letting this contrivance fall into the Current, along the Rocks, where the Hemp being turned about, and engaged in the Coral, there need sometimes many Boats to draw away the Instrument.

Bezoar he saith, is not onely found in *Golconda*, in the Province of *Renquery*, in the Maw of Goats, whereof some are at times furnisht with a dozen a piece; but also at *Macassar*, in the Isle of *Celebes*, in the Body of Apes; bigger than those found in *Golconda*. He mentions, that the people in those parts, to find whether a Goat hath any of those *Bezoar-stones* in its body, do beat his belly with their hands, and rub it, till all the stones in the Animal come together, and then they feel and tell them, as you do stones in a Bag, *&c.*

F I N I S.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, and *James Allestry* in *Duck-Lane*, Printers to the *Royal Society*, 1667.

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Fig. 1.

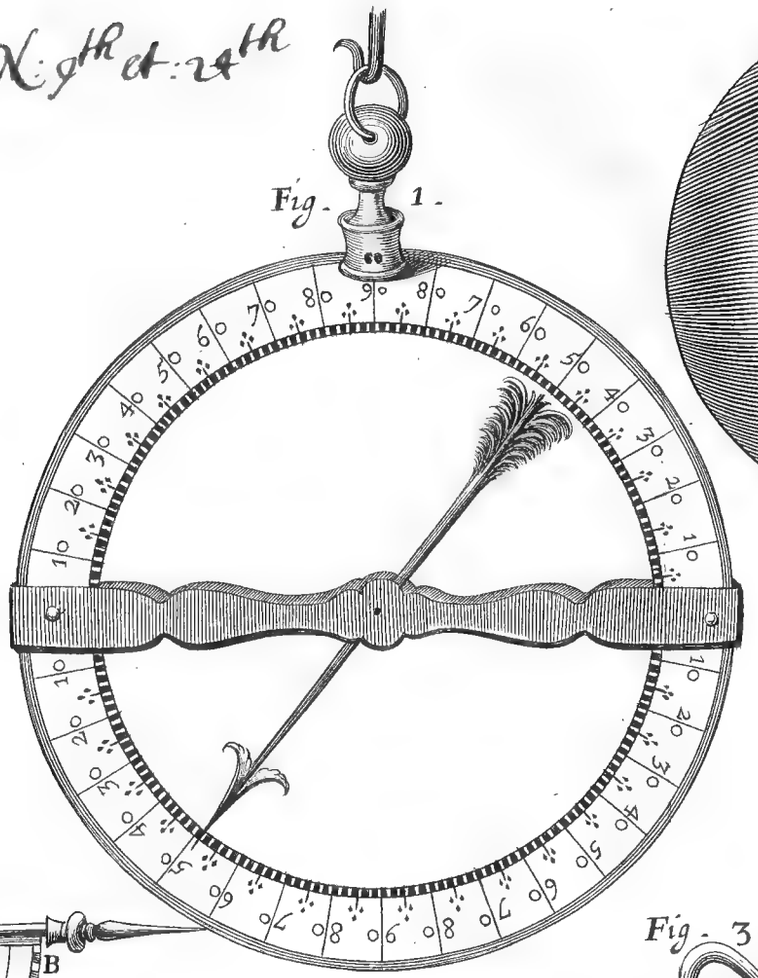
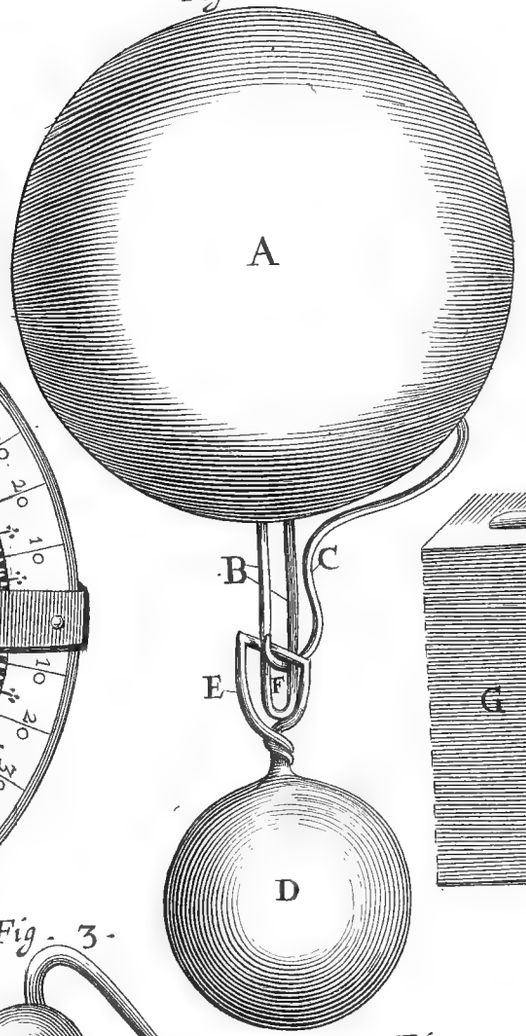


Fig. 2.



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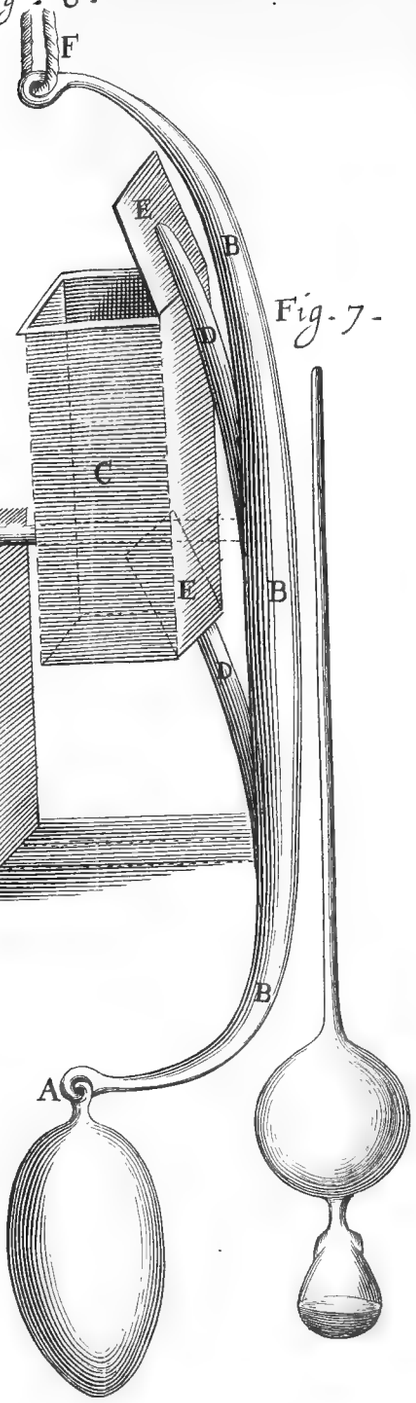


Fig. 7.

Fig. 6.

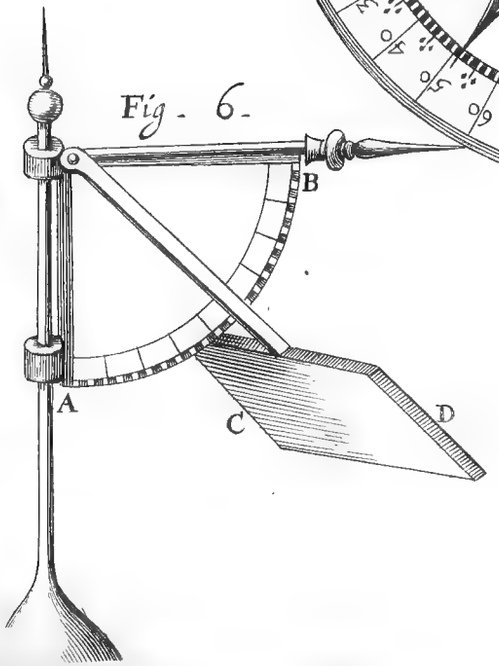
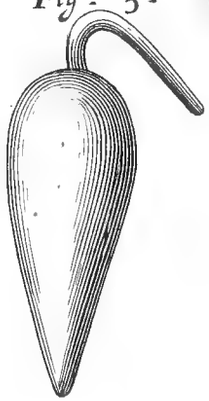


Fig. 3.



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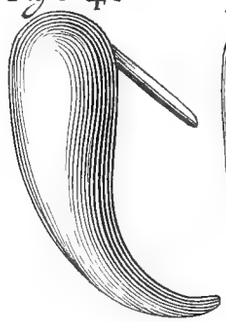
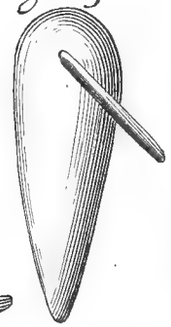


Fig. 5



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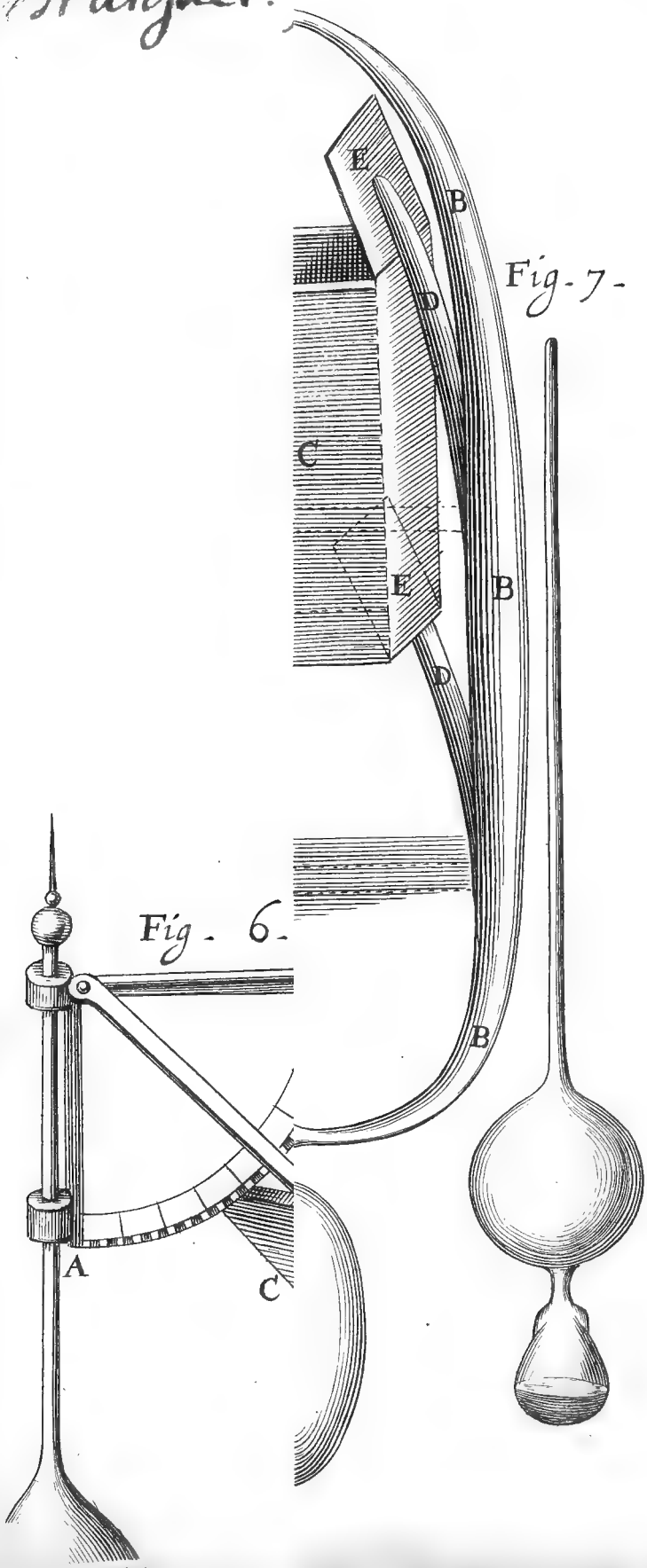

Fig. 7.

Fig. 6.

PHILOSOPHICAL TRANSACTIONS.

Monday, April 8. 1667.

The Contents.

Directions for Obſervations and Experiments to be made by Maſters of Ships, Pilots, and other fit Perſons in their Sea-Voyages: Printed with Enlargements and Explications of what was formerly publiſht of this Kind; ſuggeſted partly by Sir R. Moray, *partly by Mr.* Hook; *as, The ſeveral wayes of Obſerving, both at Sea and Land, the* Declinations *and* Variations *of the* Needle: *Some wayes of knowing the different Gravities of Sea-water: A Form of a* Scheme, *repreſenting at one view, to the eye, Obſervations of the Weather for a whole Moneth,* &c.

DIRECTIONS

For Obſervations and Experiments to be made by Maſters of Ships, Pilots, and other fit Perſons in their Sea-Voyages.

THough the Art of Navigation, one of the moſt uſeful in the World, be of late vaſtly improved, yet remain there many things to be known and done, the knowledge and performance whereof, would tend to the accompliſhment of it: As the making of exact *Mapps* of all Coaſts, Ports, Harbors, Bayes, Promontories, Iſlands, with their ſeveral Proſpects and Bearings; Deſcribing of Tydes, Depths, Currents, and other things conſiderable in the Seas: Turnings, Paſſages, Creeks, Sands, Shelves, Rocks, and other dangers: Nice Obſervations of the Variations

and Dippings of the Needle, in different places, and in the ſame place, at different times: The Winds, Weather, and Tempers of the Seaſons every where: The great Depths, Ground, and Vegetables at the bottom of the Sea: The various Degrees of Saltneſs of the Sea-water, in ſeveral places, and at ſeveral Depths at the ſame place. If beſides Aſtronomical things, to be hereafter lookt into, the following Experiments be carefully made, and Directions obſerved by as many Ingenious Perſons, as have opportunity, it may fairly be hoped, that from multitudes of Experiments and Obſervations, ſuch Rules may be framed, as may be of ineſtimable uſe for Seamen. To which purpoſe, the *Royal Society*, having ſome years ago, ordered that Eminent Mathematician Maſter *Rooke*, one of their Fellows, and *Geometry* Profeſſor of *Greſham Colledge* (ſince deceaſed, to the great detriment of the Common-wealth of Learning) to draw up ſome Directions for Seamen, the better to capacitate them for making ſuch Obſervations abroad, as might be pertinent and ſuitable to the purpoſes above-mentioned; ſuch Directions were drawn up accordingly, and ſoon after printed in *Numb.* 8. of theſe *Tranſactions*. But, further to encourage and facilitate the Work of thoſe, that ſhall be engaged to put them into practice, it was thought fit, that what of this Kind was heretofore but barely propoſed, ſhould now be publiſht with ample and particular Explanations, and conſiderable Additions; which done, a good Number of ſuch printed Copies is, by the Care, and at the Expences of the *R. Society*, to be lodged with the Maſter of *Trinity-Houſe*, to be recommended to ſuch, as are bound for far Sea-Voyages, and ſhall be judged fit for the performance: who are alſo to be deſired, to keep an exact *Diary* of ſuch Obſervations and Experiments, and deliver at their return a fair Copy thereof to the Lord High Admiral of *England*, his Royal Highneſs the *Duke of York*, and another to *Trinity-Houſe*, to be peruſed by the ſaid *R. Society*.

The

The Particulars themſelves follow:

1. *To obſerve the Declinations and Variations of the Compaſs or Needle from the Meridian exactly, in as many Places as they can, and in the ſame Places, every ſeveral Voyage.*

AT *Land*, where by the help of good fixt Dials, and other fit Inſtruments, the preciſe *Meridian* of the place may be known, it is eaſie to find the *Variation* of the *Needle*, divers wayes: As, by applying of the Needle, *&c.* to the *Shadow of a Thred* hanging perpendicular, when the Sun is in the *Meridian*; or to the *Meridian Line*; or the *Side of a fixt Horizontal Dial*, *&c.*

But at *Sea*, in regard the *Meridian* is not ſo eaſie to be found to any tolerable exactneſs, to know the *Variation of the Needle*, is much more laborious and difficult. The *Height of the Pole*, and the *Suns Declination* being known, a large *Ring-Dial*, truly wrought, having a Box with a Compaſs or Needle fixt to its *Meridian* below, may go as near as any other Inſtrument, to ſhew the *Variation* required. For, when it is ſet to the juſt hour and minute of the day, the *Meridian* of it ſtands juſt in its due place; and ſo ſhews how far the *Needle* varies from it, as exactly as the largeneſs of the *Card* will permit.

But becauſe theſe *Dials* are ſo rarely juſt, *&c.* though they may be uſed and taken notice of, yet are they not to be relied on. The thing therefore is to be performed, as followeth:

Find out the *Suns Azimuthal Diſtance* from the Meridian, ſome hours *before*, or *after* Noon, and then its *Magnetical Azimuth*, or Diſtance from the *Meridian* pointed at by the *Needle*, and the Difference of theſe two Diſtances, is the Variation of the Needle.

To find the Suns true *Azimuth*, or by how many Degrees, *&c.* of the *Horizon* it is diſtant from the *Meridian*: its *Declination*, its *Altitude*, and the *Elevation of the Pole*, muſt all three be known.

For finding whereof, every Expert Mariner is inſtructed, or may be ſo, from his Sea-Books, and ſo it needs not here to be ſet down. Nor how by the help of theſe, the *Azimuth* required may, to Degrees, if not nearer, be found out upon a good *Globe* or *Planiſphære*, (whereof there is a deſign to have one, that is, the *Analemma*, contrived into a form of Inſtrument for the uſe of the publick, and that ere long; which will with great facility perform all that the Globe can do, with much more exactneſs and conveniency) that being ſufficiently known.

But to do it accurately, you muſt conſtitute a *Spærical Oblique-angled Triangle*, of the three Complements, of the *Suns Declination*, its *Altitude*, and of the *Height of the Pole*; the meaſures of all the Sides whereof are known; One from the *Zenith* to the *Pole*; another from the *Pole* to the *Point of the Suns Altitude*; and the third, from *that point to the Zenith*. Now by thoſe you are to find out the Angle at the *Zenith*, which being found, ſubſtract it from 180, and the remainder is the Suns true *Azimuth*, or Diſtance from the *Meridian* of the Place.

This Angle is to be found divers wayes, as by the *Tables* of *Sines*, *Logarithmes*, *&c.* the manners of doing whereof, are ſet down and demonſtrated by *John Newton* in his *Inſtitutio Mathematica*, Caſe 11. and in other Books of *Trigonometry*.

And the true *Azimuth* of the *Sun* being thus found, and the *Magnetical Azimuth* of it, according to your Needle, obſerved, ſubſtract the leſſer Number from the greater, and the Remainder is the Variation of the Needle. If the *Magnetical Azimuth* be leſſe than the other, then the Variation is towards the ſame ſide of the *Meridian*, where the Sun is; if greater, on the other.

To obſerve the *Suns Azimuth* by the Needle, and the Needles Variation to Degrees, any Needle, long enough to afford upon a Card under it, a Circle divided into Degrees, put in a Square Box, after the ordinary manner of *Clinatories*, will ſerve turn; by placing the Box ſo, as the Sun may ſhine upon any two oppoſite ſides of it, at the ſame times that the *Suns Height*, *&c.* are taken: For then the Needles Diſtance from the Diameter of the Circle on the Card, that is parallel to thoſe ſides, is the *Magnetical Azimuth* required.

The

The ſame may be done with an ordinary *Sea Compaſs*, ſo it have a Circle towards the Limb of the Card, divided into Degrees, by faſtening a ſmall Thred, Lute-ſtring or Wire (not of Iron) ſo upon it, as to paſs juſt over the Center of that Circle; and placing a ſtrait piece of Wood or Braſs-wire perpendicular on the edge of the Box at the end of the Thred, and turning it to the Sun, till the Shadow of it fall juſt upon the Thred: then obſerve, what Degree of the Circle on the Card the Thred cuts, by looking plum upon it; and that is the Suns *Magnetical Azimuth*.

But to have the *Variation* to *Degrees* and *Minutes* (which is moſt deſirable) then the Obſervation laſt mention'd muſt be made with a *Quadrant*, *Sextant*, or ſome ſuch other Inſtrument, ſo large as to admit of the diviſion of a *Degree* into *Minutes*; which will require the *Radius* to be about three foot; the larger the better. If a *Quadrant*, then, it being laid flat, and the Square Box with the Needle placed upon it, move the *Quadrant* to and again, till that ſide of it, on which the Box is placed, lie parallel to the Needle, when at quiet: Then the *Sight* of the *Quadrant* being ſlid along the Rimb of it, till the Sun ſhine on both its ſides at the ſame time, the Mid-Line, that divides equally the *Sight*, when the Sun ſhines upon it thorow the ſlit, will mark the Degree and Minute of the Suns *Magnetical Azimuth*. All which is eaſie to be put in practice.

And if many ſuch Obſervations be made by ſeveral perſons at the ſame place, and by the ſame or other perſons diſtant from one another, 1. 10. 20. or more Years; Not only will the Compaſs become more uſeful than formerly, even to be conducive poſſibly to the finding the Longitude at Sea, at leaſt in ſome places: but the variation of the variation of the Needle being known in different places, all will be reduced to Rules, and ſo from hence, Philoſophical or Natural Knowledge, will probably be enlarged by a happy diſcovery of the true cauſe of the *Verticity*, or *Directive* faculty of the Loadſtone; one of the *Nobleſt* and moſt *abſtruſe Phanomena*, that falls under the cognizance of humane Reaſon.

To find this variation by the Stars, is ſo eaſie, as every Maſter can do it; ſeeing there is no more requiſite, than to find out the true *North*, that is, the *Meridian*, and compare the Needles poſiti-

on

on with it. By this means, the variation may be had well enough to degrees, half degrees, and ſome ſmaller parts; and if carefully and curiouſly proſecuted, even to Minutes too. But it will not be amiſs, to do it both by the Sun and Stars, that the greater certainty may be attained.

2. *To carry Dipping-Needles with them.*

THe *Dipping-Needle* is to be uſed at leaſt as frequently as the former Experiment is made, and in the ſame places, in order to the ſame purpoſes. All that needs be ſaid of the Manner, is, that when the Dipping of the Needle is to be examined, the Circle, in which it moves, is to be hung perpendicular, and turned, till it be juſt in the *Magnetical Meridian*, where it dippeth moſt, and the degree of its depreſſion under the *Horizon* is to be noted in a *Table*. See *Figure* 1.

3. *To mark carefully the Flowings and Ebbings of the Sea, in as many places as may be.*

THe Particulars here to be regarded, are, 1. The preciſe times of the beginnings of the Flood and Ebb, in all Rivers, Bayes, at Promontories, Capes, and in all Roads, Harbours, &c. 2. Which way Currents run in all places, with their Times, Changes, &c. 3. What perpendicular Diſtance there is, between the higheſt reach of the Tide, and loweſt of the Ebb, both of all Spring-Tides and Neap-Tides, with their irregularities, &c. 4. What day of the Moon's age, and what times of the Year the higheſt and loweſt Tides fall out: and all other conſiderable Accidents obſervable in Tides, chiefly in and near all Sea-ports, Harbours, Roads, Iſlands, &c. as St. *Helens Iſland*, *Bermudas*. 5. The poſition of the Wind at every Obſervation of the Tides, &c.

4. *To*

4. *To remark curiouſly the Scituation, Figures, &c. of all dangerous Rocks, Sands, Channels, Entries, and Courſes of Rivers, and all difficult Paſſages and Courſes in all places; to meaſure and deſcribe the ſame Exactly, their diſtances, bearings, &c. As alſo the Proſpects of remarkable Coaſts, Promontories, Ports, Iſlands, &c. in the ſame manner; and make Draughts, Plots, and Maps of them, with their Longitudes, Latitudes, Scales, &c. and all Beacons, Buoyes, Landmarks, Light-houſes, &c. which ſerve for directing the Courſe of Ships through narrow Channels, over Bars and Banks, into Rivers, Ports, Bayes, &c. And to ſound Depths near all Coaſts, in all ſhallow Places, Roads, &c.*

5. *To ſound the deepeſt Seas without a Line, by the help of an Inſtrument, repreſented by Figure 2.*

TO perform this, take a Globe of *Firr*, or *Maple*, or other light wood, as A, let it be well ſecured by Verniſh, Pitch, or otherwiſe, from imbibing Water, then take a piece of Lead or Stone, D, conſiderably heavier, than will ſink the Globe: Let there be a long

long Wire-ſtaple B, in the Ball A, and a ſpringing wire C, with a bended end F, and into the ſaid Staple, preſs in with your fingers the ſpringing Wire on the bended end: and on it hang the weight D, by its hook E, and ſo let Globe and all ſink gently into the Water, in the poſture repreſented in the ſaid *Figure*, to the bottom, where the weight *D* touching firſt, is thereby ſtopt; but the Ball, being by the *Impetus* it acquired in deſcending, carried downwards a little after the weight is ſtopt, ſuffers the ſpringing Wire to fly back, and thereby ſets it ſelf at liberty to re-aſcend. And by obſerving the time of the Ball's ſtay under Water (which may be done by a Watch, having Minutes and Seconds; or by a good *Minute-Glaſs*; or beſt of all, by a *Pendulum*, vibrating Seconds; the which muſt be three foot, three inches, and one fifth of an inch long, *viz.* between the middle of the Bullet and the upper end of the Thred, where it is faſtned, or held when it vibrates.) You may by this way, with the help of ſome *Tables*, come to know any depth of the Sea.

Note, That care muſt be had of proportioning the weight and ſhape of the *Lead*, to the bulk, weight, and figure of the *Globe*, after ſuch a manner, as upon experience ſhall be found moſt convenient.

In ſome of the Trials already made with this Inſtrument, the Globe being of *Maple-wood*, well covered with Pitch, to hinder ſoaking in, was $5\frac{13}{16}$ inches in *Diameter*, and weighed $2\frac{1}{5}$ pounds; the Lead, of $4\frac{1}{2}$ pounds weight, was of a *Conical* (but is now uſed of a *Globous*) Figure 11 inches long, with the ſharper end downwards, $1\frac{9}{16}$ at the bottom in *Diameter*. And in thoſe Experiments made in the *Thames*, in the depth of 19 foot water, there paſſed between the Immerſion and Emerſion of the Globe, 6 Seconds of an hour; and in the depth of 10 foot water, there paſſed $3\frac{1}{2}$ Seconds, or thereabouts: From many of which kind of Experiments, it will likely not be hard to find out a method to calculate, what depth is to be concluded from any time of the like *Globes* ſtay under water: As for inſtance, if in the depth of 20 fathom, meaſured by the Line, the Globe ſtay under water 15 Seconds; then if the Ball ſtay 700 Seconds, the depth of the Sea is 933 fathom and 2 foot, if the Ball be found to move equal ſpaces in equal time.

In

In the ſame Trials made with this Inſtrument in the ſaid River of *Thames*, it has been found, that there was no difference in time, between the ſubmerſions of the Ball at the greateſt depth, when it roſe two Wherry's length from the place where it was let fall (being carried by the Current of the Tyde) and when it roſe onely a Yard, or ſo, from the ſame place, where it was let down: And that it muſt be ſo in great depths and ſtronger Currents, is as certain, as eaſie to be demonſtrated.

And if it be alledged, that it muſt be known, when a *Light* Body aſcends from the bottom of the Water to the Top, in what proportion of time it riſes; it may be conſidered, that in this Experiment the times of the Deſcent and Aſcent are both taken and computed together; ſo that, for this purpoſe, there needs not the nicety, which is alledged.

OF other Experiments of this way of ſounding without a Line, made by the Noble Lord Viſcount *Brounker*, Sir *Robert Moray* Knight, and Mr. *Hook*, in the Channel at *Sheerneſs*; the following Account was given, *Vid.*

Weighed	*Ounc.*	*Grains.*
A Wooden Ball (*A*) ——	32 $\frac{9}{16}$	00
Another Wooden Ball (*B*) ---	30	22
A Lead (*A*) ——	30	00
Another Lead (*B*) ——	30 $\frac{3}{4}$	00

The Ball (*B*) and the Lead (*B*) were let down at 16 fathom; and the Ball returned in 48 ſingle ſtrokes of a *Pendulum*, held in the hand, vibrating 58 ſingle ſtrokes in a *Minute*.

A ſecond time repeated with the ſame ſucceſs; therefore, the motion was 4 foot every ſecond.

Again the Ball (*A*) and the Lead (*B*) whoſe Nail was bended into a ſharper Angle; the Ball returned in 39 ſtrokes. A ſecond time repeated with the ſame ſucceſs, at the ſame depth.

Ball (*B*) Lead (*B*) in which trial the Line, not being clear, ſtopped a little the motion; the Ball returned in 47 at the ſame depth.

Ball (*A*) Lead (*A*) at 8 fathom and 1 foot, returned at 20; repeated at 8 fathom, returned at 19.

Tried the third time at 10 fathom and 4 foot, return'd at 28.

A fourth Trial, at the ſame depth, juſt the ſame.

A fifth, at 10 fathom, 5 foot, returned in 27.

A ſixth Trial, juſt the ſame.

A ſeventh, at 12 fathom, 5 foot, in 37.

An eighth Trial, juſt the ſame.

Another Day, near the ſame place.

Note, That the *Pendulum* was this Day adjuſted, and made a little ſhorter, there having been but 58 vibrations in a *Minute*, the other Day.

Ball (*A*) Lead (*B*) at 14 fathom, returned in 32 $\frac{1}{2}$.

A ſecond Trial, a little after in the ſame place, returned in 33. In making of which Trial, the Vibrations were told aloud, and the Lead having been let down by a Line, was found to touch the bottom in juſt half the time, the Ball ſtaid under water. By a ſecond Trial, the Aſcending and Deſcending was found to be in equal times. And by a third Trial with another Lead, the very ſame was found, *vid.* 16 $\frac{1}{2}$ deſcending, and 16 $\frac{1}{2}$ aſcending. This Lead and Ball let down without a Line, the Ball returned in 13 vibrations; a ſign it went not to the bottom.

A Trial made with a Lead, whoſe *Iron*-Crook was faſten'd at the top of it (like that in the *Figure* 3.) ſucceeded very well, and the Ball returned in 34 $\frac{1}{2}$. But by reaſon of the Current, the Experimenters could not perceive, when the Lead touched the bottom. This Lead being let down without a Line, the Ball returned in 32 $\frac{1}{2}$. The depth of the water was now found by the Ships Lead, to be 14 fathom.

Another Trial was made with a Line, bowing the point of the Lead (like that in the *Fig.* 4.) and the Ball return'd in 34. The ſame let down without a Line, the Ball return'd in 6 or 7 vibrations; a ſign again, it went not to the bottom.

In a Trial with another Lead, the Ball return'd in 34.

Repeated again with the ſame ſucceſs.

In

In a Trial with a Lead, whoſe Nail was ſet awry (like that of the *Fig* 5.) the Ball returned in 34. After which Trial, the depth was found to be juſt 14 fathom.

The laſt Lead and Ball being let down without a Line, the Ball returned at 35.

In another Trial with a Lead that never failed, the Ball returned in 34, and the Lead toucht the bottom at 17.

By a Trial with another Lead, the ſame time was found exactly.

By a third Trial with this laſt, the very ſame.

Theſe Trials were made near about High-water, at the depth of 14 fathom juſt by meaſure: And in them, the motions ſeem to be 5 foot every ſecond.

In all theſe Trials, the greateſt difficulty was, in the uſe of Conical Figures, with Iron Crooks, to bend the Iron, that it might be ſure to carry down the Ball with it to the bottom, and when come thither, to let it go: for almoſt every one of theſe Leads failed in one of theſe requiſites, till by ſeveral Trials they had been adjuſted.

It is not to be omitted, That the laſt Trials being made near High-water, the Ball was found to riſe (by the Boat, being permitted to drive) far off upon one ſide, out of the way, that any light thing, ſuffered to ſwim on the water, would be carried; which ſeemed to argue a motion of the under parts of the water, differing from that of the upper (a thing which is ſaid to be at certain times of the Tydes, both at the mouth of the *Sound*, and of the *Streights*; which deſerves to be further inquired into.) The Angle made by theſe different motions, ſeemed to be about 40 *Degrees*.

6. *To keep a Regiſter of all changes of Wind and Weather at all hours by Night and by Day, ſhewing the point, the Wind blows from, whether ſtrong or weak: The Rains, Hail, Snow, and the like; the preciſe times of their beginnings and continuance: eſpecially* Hurricans, *and* Spouts; *but above all to take exact care to obſerve the* Trade-Winds, *about what degrees of* Latitude *and* Longitude *they firſt begin,* where *and* when *they ceaſe or change, or grow ſtronger or weaker, and how much; as near and exact as may be.*

THe ſtrength of the Winds is meaſured by an Inſtrument, ſuch as is repreſented by *Figure 6*; which being expoſed to the Wind, ſo as the flat ſide may be right againſt it, the number of *Degrees* upon the *Limb A B*, to which the Wind blows up, or raiſes, that flat ſide *C D*, ſhews the force or ſtrength of the Wind, in proportion to the reſiſtance of the flat ſide of the Inſtrument; and is to be recorded.

The

The *Form* of a *Scheme*,

Which at one view represents to the Eye Observations of the Weather, for a whole Moneth, may be such, as follows.

Days of the Moneth, and Place of the Sun.	Remarkable hours.	Age and Sign of the Moon at Noon.	The Quarters of the Wind, and its strength.	The Faces or visible appearances of the Sky.	The Notablest Effects.	General Deductions. These are to be made after the side is filled with Observations; as,
June 14 ☌ 2.46′	4	27	W - - 2	Clear blue, but yellowish in the *NE*.	A great Dew.	From the last Quarter of the Moon to the Change, the weather was very temperate, but, for the Season, cold; the Wind pretty constant between *N*. and *W*.
	8	———	- - - - 3	Clouded toward the *South*.		
	12	☌ 9. 46′	- - - - 3 ½		Thunder far to the S.	
	4	*Perigeum*	- - - - - - -	Checkered blue.		
	8		WSW 1		A very great Tyde.	
	12		- - - - - - -			
15 ☌ 3.40′	8	28	N W 3	A clear sky all day, but a little checker'd about 4 *P. M.* At Sun-set red and hazy.	Not by much so big a Tyde as yesterday. A great Thunder-Showre from the *N*.	*&c.*
	4	———	4			
	6	☌ 24.51′	N 2			
	12		1			
16 ☌ 4.57′ *&c.*	10	*New Moon at* 7.25′ *A. M.* ♍ 10.8′ *&c.*	S 1 *&c.*	Overcast and very lowring, *&c.*	No Dew upon the ground, but very much upon Marble-stones, *&c.*	

7. *To observe and record all Extraordinary* Meteors, *Lightnings, Thunders,* Ignes fatuos, *Comets,* &c. *marking still the places and times of their appearing, continuance,* &c.

8. *To carry with them good Scales and Glass-Viols of a pint or so, with very narrow mouths, which are to be fill'd with Sea-water in different degrees of* Latitude, *and the weight of the Viol full of water taken exactly at every time, and recorded; marking withal the degrees of* Latitude *and* Longitude *of the Place, and the Day of the Moneth, and the Temperature of the Weather: And that as well of Water near the Top, as at a greater Depth.*

THe Viol is to be made with a very narrow Neck, and when it is almost full, water is to be dropt into it, drop by drop, till it can hold no more, drying well the Viol before it be weighed. The weight of the empty Viol is also to be recorded every time, weighing all to grains. And by evaporating gently the water, till the Salt be left dry on the bottom; they, who lift, may have the satisfaction to know, what proportion the Salt of each water holdeth to its weight.

There is, among some other wayes of finding the different gravities of Water, a very pretty one, mentioned by some Authors, as *Johannes Toldenus* (a *German* Artist) *Cabæus*, and *Kircher* in his

his *Fundus Subterranæ*, and improved and first brought into use here, divers years ago, by the Noble *R. Boyle*, who also, as himself informed the Publisher, hath in some of his Writings, yet unpublisht, set down a full Description thereof.

It is such a Glass-Tube as is represented by *Fig.* 7. blown at a Lamp, and poised in good common Water by putting *Quick-silver* into it, until it sink so low, that nothing appear above the Superficies of the Water, but the Top; which done it is to be sealed up, and to be graduated on its side, into what parts you please; which may be done with a Diamond. And then, being put into any Water to be weighed, it will, by its more or less sinking into it, shew the differences of the Waters gravity.

9. *To fetch up VVater from any Depth of the Sea.*

TO perform this, let there be made a *Square Woodden Bucket* (such as *C* in *Fig.* 8.) whose bottoms *E E* are to be so contrived, that the weight *A* do sink the Iron *B* (to which the *Bucket C* is fastned by two Handles *D D*, on the ends of which are the moveable bottoms or Valves *E E*) and thereby draws down the *Bucket*; the resistance of the Water keeps up the *Bucket* in the posture *C*, whereby the Water hath a clear thorow-passage all the while it is descending: whereas, as soon as the *Bucket* is pulled upwards by the Line *F*, the resistance of the Water to that motion, beats the *Bucket* downward, and keeps it in the posture *G*; whereby the included Water is preserved from going out, and the Ambient Water kept from getting in.

By the advantage of which Vessel, or such like, you may come to know the *Degrees of Saltness* of Sea-Water, according to its nearness to the Top or Bottom; or rather, the Constitution of the Sea-Water in several Depths of several *Climats*: Likewise, whether in some places of the Sea, there be any Sweet Water at the Bottom; the *Affirmative* whereof is to be met with in the *East-Indian-Voyages* of *Van Linschoten*, who *pag.* 16. of that Work, as 'tis *Englished*, records, that in the *Persian Gulph*, about the Isle of *Baharem*, they fetch up with certain Vessels (which he de-

deſcribes not) Water out of the Sea, from under the Salt-Water, four or five fathoms deep, as ſweet as any Fountain-water. And ſince 'tis argued by ſome, that ſuch Sweet-Water proceeds from certain Sweet Water-Springs, that were formerly on the Continent, at ſome diſtance from the Sea, and came afterwards to be covered by the Sea; it may be preſumed, that in other places we may find the like. Beſides, we know not, but that there may be in many parts, Eruptions of large Springs at the Bottom of the Sea, that were never taken in by any of its encroachments.

Theſe Experiments are to be repeated every New Voyage, the multitude and frequency of them being neceſſary for finding out and confirming the truth of them; which as it will conduce exceedingly to the Enlargement of Natural Knowledge, ſo it may in time produce New and more accurate Sea-Maps *and* Cards, *than hitherto have been publiſht; and great helps and advantages to Navigation: eſpecially thoſe of the* Variation, *and* Dipping *of the* Needle; *the* Depth *and* Saltneſs *of the* Water; *the Nature of the* Ground *at the* Bottom *of the Sea; and indeed almoſt every one of the reſt; there being a Deſign to conſider all, and to draw out of them ſuch Rules and Directions, as may bring no leſs Honour, than Benefit to the* Engliſh *Nation.*

The Inſtruments, deſcribed and repreſented in theſe Papers, may be had from Mr. *Richard Shortgrave*, Operator to the *R. Society*, to be found at *Greſham Colledge*; who alſo will be ready, if there be occaſion, to give more particular Directions for the uſe of the ſame.

ADVERTISEMENT.

IT *is deſired by* Chriſtopher Merret M. D. *to inform the Publick, that within the ſpace of four Moneths, he ſhall re-publiſh his* Pinax Rerum Naturalium Britannicarum, *with many Additions, and in his propoſed New Method; and that he wholly diſclaims the* Second *Edition of that Book, as being printed and publiſhed without his knowledge.*

In the *SAVOY*,
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PHILOSOPHICAL TRANSACTIONS.

Monday, May 6. 1667.

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An Account
Of an eaſier and ſafer Way of Transfuſing Blood *out of one Animal into another*, viz. *by the* Veins, *without opening any* Artery *of either.*

This Way was firſt practiſed (for ought we know) by Doctor Edmond King, *and the ſucceſs thereof in two Experiments, communicated by him to the* Royal Society, *as follows,*

1. I took a Calf and a Sheep, both of the larger ſort, and having prepared a Jugular *Vein* in each, I planted my Pipes and Quills, as is uſual, both in the Jugular *Vein* of the Calf (deſigned to be the *Emittent*) and in that of the Sheep (intended for the *Recipient*.) Then I took out of the Sheep 49 *ounces* (*Haver de pois weight*) of blood, before any other blood was let in; about which time, the company concluding the Sheep to be very faint, and finding the blood to run very ſlowly, I ſtopp'd the Vein of the Sheep, and unſtopp'd the Pipe in the Calf, letting run out 10 *ounces* into a Porringer, which was done in about 40 *ſeconds of a Minute*. Then I convey'd Pipes from the Emittent Calves Vein, into the Recipient Sheeps Vein, and there ran a good free ſtream of blood for the ſpace of 5 *minutes* (though perhaps leſſe ſwift than the firſt 10 *ounces*.) And not to be deceived in the running, I did often ſtrike with my finger the upper part of the emitting Vein, and thereby eaſily felt every ſtroke anſwered on the Recipient Vein, juſt like a *Pulſe*. And now ſuppoſing that by this time (*viz.* the lapſe of 5 *minutes*) the Sheep had received as much, if not more blood, than it had loſt, we ſtopp'd the current of blood from the Calf, and cloſed alſo the Vein of the Sheep; and then having untied her, and ſet her down in the room, ſhe went about and appeared to have as much ſtrength, as ſhe had before the loſs of her own blood. Then reſolving to bleed the Sheep to death, we bound her the ſecond time, and open'd the emittent part of the Vein again; whereupon having bled about 60 *ounces*, ſhe fell into Convulſions; and after the loſs of about 5 *ounces* more, ſhe died upon the place: and being dreſs'd by the Butcher, there did not, in all the uſual places, appear above 3 *ounces* of blood; and the whole Sheep look'd of a lovely white; and the meat of it (to the taſte of thoſe, that eat of it) was very ſweet.

The Sheep being dead, we reſolv'd likewiſe to ſee the Calf bleed to death; but he having bled 10 *ounces*, and then for the ſpace of 5 *minutes* more into the Sheep, and reſted a good while, the blood by that time began to coagulate in the Vein; which made me open the *Carotid Artery*, letting thence run out about 25 *ounces* of blood, of a very lovely and vivid colour, vaſtly excelling

celling therein the blood of the Vein. The Calf, when dreſs'd, had, by the information of the Butcher, as little blood as the Sheep; and we ſaw him look whiter, than uſually they do in the ordinary way of killing.

2. I took out 45 *ounces* and better, of blood, out of the *Jugular Vein* of a Sheep, of a leſſer ſize than the former; by which time, the Spectators, as well as my ſelf, found her exceeding faint, and ſome thought her paſs'd recovery, without a ſupply of blood. Then I convey'd blood from the *Jugular Vein* of a Calf into that of the Sheep, for the ſpace of 7 *minutes*, when we did believe, by the continuance of a good ſtream from the Calf, that the Sheep had already received more blood, than ſhe had loſt. Whereupon we ſet her free, and ſhe had no ſooner got her liberty, but ſeeing a Dog near her (which was a Spaniel, that had formerly ſuffered the tranſmiſſion of Sheeps-blood into him) ſhe butted with great violence at him three or four times, not appearing at all concern'd at what ſhe had endured in the Experiment. We keep this Sheep alive, ſhe being ſent to graſs again, and ſeeming hitherto very ſtrong and luſty.

The Calf was much larger than the Sheep. We bled the Calf to death, and received from him ſix Porringers full of blood, after the Sheep had been ſuppleid, each Porringer containing $11\frac{1}{2}$ *ounces* of water. The Sheep loſt four of the ſame meaſures full of blood; which being ſupply'd by that of the Calf, we reckon, that the Calf loſt 10 ſuch meaſures in all.

An Account
Of another Experiment of Transfuſion, *viz. of Bleeding a* Mangy *into a* Sound *Dog.*

This was made by Mr. Thomas Coxe, *and imparted likewiſe to the* Royal Society *in manner following.*

I procured an old Mungrell *Curr*, all over-run with the Mainge, of a middle ſize, and having, ſome hours before, fed him plentifully with Cheeſe-parings and Milk, I prepared the *Jugular Vein*,

as we uſe to do the *Carotidal Artery* of the *Emittent* Animal, not deſigning any thing further, than to determine by Experiment the Infection of the *Recipient's* blood. Then I made as ſtrong a Ligature upon the Dogs Neck, as I durſt, for fear of choaking him, to the end, that the *Venal* blood, which is much more ſluggiſh in its motion and evacuation, than the *Arterial*, might be emitted with the greater advantage of *Impetus*.

Then I took a young *Land-Spaniel*, of about the ſame bigneſs, and prepared his Jugular Vein, as is uſually done in the *Recipient* Animal; the *heart-ward* part of the Vein to receive the Maingy Dogs blood, and the *head-ward* part of it to diſcharge his own into a Diſh.

Having thus prepared them both, and placed them in a convenient poſture one to the other, I let ſlip the running knots, and by frequent compreſſion of the Neck (beſides the Ligature I had made) by reaſon of the tardy running of the *Venal* blood out of the *Emittent*, transfuſed about 14 or 16 *ounces* of the blood of the *Infected*, into the Veins of the *Sound* Dog, as neer as I could gueſs by the quantity of blood, which ran into a Diſh from the *Recipient*; ſuppoſing the *Recipient* Animal to loſe near about the ſame proportion to what the *Emittent* ſupplies.

The effect of which Experiment was, no alteration at all, any way, to be obſerved in the Sound Dog. But for the Maingy Dog, he was in about 10 dayes or a fortnights ſpace perfectly cured: which might with probability enough, I think, have been expected from the conſiderable evacuation, he made; (perhaps the quickeſt and ſureſt remedy for the cure of that ſort of diſeaſe, he was infected with, both in Man and Beaſt.)

An

An Extract
Of a Letter of M. Denis *Prof. of Philoſophy and Mathematicks to M. * * * touching the* Transfuſion of Blood, *of* April 2. 1667.

This we Engliſh out of the 8*th* Journal des Scavans of 1667. *Viz.*

SInce the Experiments, of which I wrote to you the 9th of *March*, we have transfuſed the blood of three *Calves* into three *Dogs*, to aſſure our ſelves, what the mixture of two ſuch differing ſorts of blood might produce. I ſhall hereafter acquaint you at large with the particulars; at preſent I ſhall onely inform you, that the Animals, into whom the blood hath been tranſmitted, do all of them eat as well as before, and that one of theſe three Dogs, from whom the day before ſo much blood had been drawn, that he could hardly ſtir any more, having been ſupplied the next morning with the blood of a Calf, recover'd inſtantly his ſtrength, and ſhew'd a ſurprizing vigor.

We have found new wayes of making this Transfuſion with ſo much facility, that M. *Emmerez* undertakes to perform it *without* any *Ligature*, onely by pricking, like that, which is uſed in *Letting of blood.*

Obſervations
Concerning the Uniting of Barks of Trees *cut, to the Tree it ſelf; made by* Chriſtopher Merret *M. D. and read before the* Royal Society *January* 9. 1666.

IN the midſt of *March An.* 1664. I made a Section of the Rinds of *Aſh*, and of the Tree, falſly called *Sycamore*. The firſt Section of each of the Rinds was ſquare, whereof three ſides were cut,

cut, the fourth uncut. The ſucceſs was, that the whole Bark did unite, by binding it with pack-thred, leaving a ſcar in each of the ſides cut.

Then I cut off and ſeparated entirely from the Tree, ſeveral parts of the Bark, ſome ſhallower, leaving part of the Bark on; others to the very wood it ſelf, both in the Trunk and Branches; from an inch ſquare to leſs dimenſions; and ſome of them I bound cloſe with pack-thred: all which were ſeparated, a new Rind ſucceeding in their place. Some I cover'd over, beyond the place of Inciſion, with *Diachylon-plaiſter*, and tied them faſt with pack-thred. All which, thus bound and plaiſter'd, did within the ſpace of three weeks, firmly unite to the Tree, not without ſome ſhriveling of the outward skin of the Bark, and alſo with ſome ſhrinking in each ſide, where the Inciſion was made; where alſo appear'd in each of the Interſtices a ſcar.

The like Experiment I made, ſome years before, about the ſame time of the year, and ſucceeded as before related. But tying the ſame about *Michaelmas*, and in the *Winter*-ſeaſon, at neither of theſe times any Union could be made of the Bark to the Tree. I ſuppoſe, it was, becauſe the Sappe mounted not ſo vigorouſly and in ſuch plenty, as in the *Spring*-ſeaſon.

Some Branches of the fore-mentioned Trees were decorticated round, and where no Union was, there certainly follow'd a withering of the Branch beyond the place, where the Section was made.

I alſo ſeparated a Twig from the Branch, by cutting of it ſloping, for the better faſtning of it to the Branch again. This Twig I exactly fitted to the Branch, from whence 'twas cut, in the ſame poſture, it before grew in: I firmly bound it, and cover'd it with *Diachylon*-plaiſter. The ſucceſs was, that in 3 dayes time, the Twig, that was cut off, withered.

An Experiment
Of making Cherry-Trees, *that have withered fruit, to bear full and good fruit; and of* Recovering *the almoſt withered fruit.*

Communicated by the ſame, as follows:

Anno 1665, I made the following Experiment with 3 *May-Cherry-Trees* (planted in a rich Mould) which lay to a South-wall, ſhaded 4 Winter-Moneths from the Sun by a high Building, ſo that the Sun came not on them, till the beginning of *March*, when being high, and ſhining ſomewhat fiercely upon them, the fruit conſtantly withered for ſome years before. Now this year, the ſeaſon being very hot and dry, I bared the roots of *one* of them, by making a hole about it, and watered it every Morning and Evening with about a *Gallon* of water, for about a fortnight before the Cherries came to redneſs, and the fruit was full and good. The other *two* Trees, left without this ordering, had moſt of their fruit withered, having onely skin and ſtones. Now to try this Experiment farther, I made a hole round about *one* of the other Trees, and fed it with water daily, as the former: In a Weeks time, thoſe that were quite withered, fell off, and the reſt, that were not ſo, grew and increaſed exceedingly; the *other* Tree, that was not uſed after this manner, had not any of its fruit come to perfection.

An Experiment
On Aloe Americana Serrati-folia *weighed; ſeeming to import a* Circulation *of the Sappe in* Plants, *by the ſame Dr.* Merret.

Auguſt 4. 1656. this *Aloes* weighed 21 *Ounces*, 6 *Drams*, 2 *Grains*. Its colour was of a pale-green, conſiſting of 11 Leaves; it was bound about with a red dry Cloth, and was hung up without Oil, as is uſual, in the Kitchin.

Auguſt

	Weight.				Loſs.	
	Ounc.	*Drams.*	*Scrup.*	*Grains.*	*Scruples.*	*Grains.*
Auguſt 19.	21	3	0	24	3	27
Septemb. 6.	21	1 ½	0	0	1	14
February 20.	21	1	0	12	0	11
March 16.	21	0	2	0	0	32
April 8.	21	0	0	0	0	40
May 1.	20	7	0	0	1	0
May 28.	20	5 ½	0	0	1 ½	0
June 12.	20	4	0	4	2	26
July 1.	20	1	0	8	2	18
July 20.	19	6	0	1	3	7
Auguſt 4.	19	3	0	12	2	49

So that in a whole year it loſt 2 *Ounces*, 3 *Drams*, 24 *Grains*. The ſucceeding year being drier and hotter, it loſt 3 *Ounces*, 2½ *Scruples*, and more than double in the 6 colder, than the 6 hotter Moneths. I kept it about 5 years, and it decreaſed much about the ſame proportion. And in the year 1660, hanging it in a colder Garret, it periſhed.

Theſe Obſervables I had about it, that every Year two of the greater Leaves firſt changed Colour, and wither'd; and in the Spring-time, there grew out two very freſh and green ones, never amounting to the bignes of any of the precedent; inſomuch, that all this time I had the ſame number of Leaves. And then, theſe new Leaves were more freſh and green, and not ſerrated, and thicker alſo in proportion to their other Dimenſions. Whence perhaps it may probably be inferr'd, *vid.* from the growth of theſe latter Leaves, that there is a *Circulation* in this Plant of the *Succus nutritius*. For, how is it poſſible, that the Roots, continuing as firm and ſolid as at firſt, ſhould ſupply ſo much nouriſhment, as to procreate *new* Leaves, unleſs it were from the return of the ſaid *Succus*, from the old and decaying Leaves, into the Root, and there protruded for the production of new ones? For, all *Bulbous* Roots, as Garlick, Onions, Tulips, and eſpecially Squils, who protrude their Leaves, placed in a Shop or Houſe, have their Roots lighter, and more ſpungy;

thee

the Leaves being formed out of the ſubſtance of the Root, as a Chick out of the *Albumen*; in the mean while the whole decreaſing in weight, as in the aforeſaid *Aloe*; as 'tis manifeſt by many Experiments made by me.

An Extract
Of a Letter, written by Mr. Richard Towneley *to Dr.* Croon, *touching the Invention of* Dividing a Foot *into many thouſand parts, for* Mathematical *purpoſes.*

FInding in one * of the laſt *Philoſophical Tranſactions*, how much M. *Auzout* eſteems his Invention of dividing a Foot into near 30000 parts, and taking thereby Angles to a very great exactneſs; I am told, I ſhall be look't upon as a great Wronger of our Nation, ſhould I not let the World know, that I have, out of ſome ſcatter'd Papers and Letters, that formerly came to my hands of a Gentleman of theſe Parts, one Mr. *Gaſcoigne*, found out, That before our late Civil Wars, he had not only deviſed an Inſtrument of as great a power, as M. *Auzout*'s, but had alſo for ſome Years made uſe of it, not only for taking the Diameters of the Planets, and Diſtances upon Land; but had farther endeavour'd, out of its preciſeneſs, to gather many Certainties in the Heavens; amongſt which, I ſhall only mention one, *viz.* The finding the *Moons Diſtance*, from two Obſervations, of her *Horizontal* and *Meridional Diameters:* Which I the rather mention, becauſe the *French Aſtronomer* eſteems himſelf the firſt that took any ſuch Notice, as thereby to ſettle the *Moons Parallax*. For, our Countrey-man fully conſider'd it before, and imparted it to an Acquaintance of his, who thereupon propoſed to him the Difficulties that would ariſe in the Calculation; with conſiderations upon the ſtrange Niceties, neceſſary to give him a certainty of what he deſired. The very Inſtrument he firſt made I have now by me, and two others more perfected by him; which doubtleſs he would have infinitely mended, had he not been ſlain unfortunately in His late Majeſties Service. He had a *Trea-*

* Vid. Numb. 21. p. 373.

tiſe of Opticks ready for the *Preſs*; but though I have uſed my utmoſt endeavour to retrieve it, yet I have in that point been totally unſucceſful: But ſome looſe Papers and Letters I have, particularly about this Inſtrument for taking of Angles, which was far from perfect. Nevertheleſs, I find it ſo much to exceed all others, that I have uſed my Endeavors to make it exact, and eaſily tractable; which above a Year ſince I effected to my own deſire, by the help of an Ingenious and Exact Watchmaker in theſe Parts: Since which time, I have not altogether neglected it, but employed it particularly in taking the *Diſtances* (as occaſion ſerved) of the *Circum-jovialiſts*, towards a perfect ſetling their Motion. I ſhall only ſay of it, That it is ſmall, not exceeding in weight, nor much in bigneſs, an ordinary Pocket-Watch, exactly marking above 40000 Diviſions in a *Foot*, by the help of two *Indexes*; the one ſhewing hundreds of Diviſions, the other, Diviſions of the hundred; every laſt Diviſion, in my ſmall one, containing $\frac{1}{10}$ of an Inch; and that ſo preciſely, that, as I uſe it, there goes above $2\frac{1}{2}$ Diviſions to a *Second*. Yet I have taken *Land-Angles* ſeveral times to one Diviſion, though (for the Reaſon mention'd by M. *Auzout*) it be very hard to come to that Exactneſs in the Heavens, *Viz.* The ſwift motion of the *Planets*. Yet, to remedy that Fault, I have deviſed a *Reſt*, in which I find no ſmall advantage, and not a little pleaſing thoſe perſons who have ſeen it, being ſo eaſie to be made, and by the Obſerver manag'd without the help of another: Which ſecond Conveni'ence, my yet nameleſs Inſtrument hath in great perfection, and is, by reaſon of its ſmalneſs and ſhape, eaſily appliable to any Teleſcope. Sir, If you think this Invention, thus imp'ov'd, worthy to be taken notice of by the Curious, you may * command a more perfect Deſcription of it, or any of the Obſervations, either M. *Gaſcoigne*, or my ſelf have made with it.

* Care is taken, to get both this *Deſcription*, and the *Obſervations*, from M. *Townly*.

More

More Wayes For the ſame Purpoſe, Intimated by M. Hook.

I Have by me (*ſaith* Mr. *H.*) two or three ſeveral wayes of *Meaſuring the Diameters* of the Planets, whether *Horizontal*, *Perpendicular*, or *Inclined*, to the exactneſs of a *Second*, by the help of a *Teleſcope*: As alſo, of taking the Poſition and Diſtance of the *Small Fixt Stars* one from another, or from any of the leſs bright *Planets*, if the Diſtance be not above two or three *Degrees*.

The Particulars hereof, the Author *refers to the next Opportunity.*

Obſervations Of the Star, called Nebuloſa, in the Girdle of Andromeda; and of the Wondrous Star in the Neck of the Whale: made and communicated by Monſieur Bullialdus.

Anno 1667. in *January*, when the Cloudy and Miſty weather, which had continued for a good while, did permit us to obſerve, the Star *Nebuloſa*, in the *Girdle of Andromeda* (which may well enough be ſeen by the bare Eye) appeared much obſcurer than the Year before. In the Months of *February* and *March* I did not ſee it.

Anno 1667, *January* 20. at Night, *h.* 6. 30'. the Sky being pretty ſerene, the Star in the *Neck* of the *Whale*, did approach to the bigneſs of a Star of the *Sixth Magnitude*, and grew bigger afterwards.

February 12, *h.* 6. 30'. I ſaw the ſame again, equalling now a Star of the *Fourth Magnitude* at leaſt.

February 24, *h.* 7. This Star was equal to thoſe of the *Third Magnitude*, ſhining very bright.

February 26, The ſame appeared yet to increaſe; as alſo *February* 27. But after this time I could not ſee it, by reaſon of the ill weather.

The ſame Aſtronomer *did ſubjoin the following Extract of a Letter he received from Monſieur* Hevelius, *March* 15. 1667. *concerning ſuch another Star*; viz.

I have watched the *New Star* in the *Neck of the Whale*, as often as the weather would give me leave, which it hath done but ſeldom this Winter. In *January*, the 3, 4, 5, 7, and 13 dayes, it did not yet appear. From this time, the Sky was continually overcaſt, till *January* 23. on which day, I found a little Star of the *Sixth* or *Seventh Magnitude*, about the ſame place where the ſaid *New Star* uſes to appear. But it then ſeemed to me not the genuine *New Star*, but another, to wit, preceding the *New*; whoſe *Longitude* hath been defined by me in *Mercurius in Sole viſus* in *Aries*. gr. 25. 43′. 3″. and the *Latitude* gr. 14. 41′. 32″. South, *Anno* 1660. Then from *January* 23, to *February* 2, it was Cloudy weather again; but this *ſecond* of *February*, it appear'd very bright, and that, when the Moon ſhone, of the bigneſs of that in the *Mouth of the Whale*, or *Nodo Lini*: from which time I alwayes obſerved it to grow bigger. *March* 13. I did ſtill find it extreamly bright, but could not by my naked Eye, becauſe of the vivid *Crepuſcle*, and the low ſite of the Star, accurately determine its Magnitude.

I have received (*ſaith he further*) your two *Monita ad Aſtronomos*; and the *Diſcourſe* hath much pleaſed me, you having not much deviated from the Truth, in reſpect of the Appearance. Heretofore I had of this, and other *New Stars*, another *Hypotheſis*; but I cannot thereby ſo accurately divine the Appearances, as you will read more largely in its due place.

See *Numb.* 22. of theſe Tranſactions, *p.* 381, 382. where an account is given of theſe two *Monita* of M. *Bullialdus*.

An Extract
Of a Letter of M. Pecquet *to* M. Carcavi, *concerning a* New Diſcovery *of the Communication of the* Ductus Thoracicus *with the* Emulgent Vein: *Taken out of the* Journal des Scavans, *N. VII.* 1667.

I Cannot forbear longer to inform you of the Experiments, which M. *Perrault*, M. *Gayant*, and I, made laſt Night upon the Corps of a Woman, that died ſome few dayes after ſhe was brought to bed.

Our Deſign was to continue the Diſcovery of the Veſſels, that carry the Chyle to the Breaſts, of which I have indicated the Way, *pag.* 134. of the *Second Edition* of my *Anatom. Experiments*, printed 1654. But the Body being not fit for that, we referred the ſearch thereof to another time; and we have had the good fortune to make another Diſcovery, which may prove not leſs uſeful to *Phyſick*; it is the *Communication of the Milky Channel*, now call'd the *Ductus Thoracicus*, *with the Emulgent Vein*. The Experiments were theſe:

1. M. *Gayant* having diſcovered the *Ductus Thoracicus* upon the 7th and 8th of the *Vertebra's* deſcending from the Back, inſerted a Quill into the ſaid *Ductus*, and having tied it upon the Quill, he did blow into it: whereupon the *Ductus* was fill'd with wind from the Quill unto the *Subclavial Vein*. This wind iſſued at the *Aſcending Cava*, which had been cut, when he, whoſe the Corps was, had lifted up the heart to make the demonſtration of it, M. *Gayant* would tie this *Cava*, but it was cut ſo ſhort, that the Ligature could not hinder the wind to iſſue out of it; which was the cauſe, that it could not be thruſt as far as the Breaſts. I would ſupply this defect, by compreſſing with my finger that place of the Vein, at which the wind came out (which was at about the third *Vertebra*, deſcending from the Back) and M. *Gayant* having blown

blown afreſh into it, I compreſſed with my fingers the *Vena Cava* and the *Ductus Thoracicus* together; but the wind, that was thruſt into this *Channel*, ſhewed us, that it had another way to eſcape. And indeed we ſaw as often as we did blow, that the *Emulgent Vein* was on the left ſide filled with wind, and that thereupon the body of the *Vena Cava* alſo filled it ſelf from the *Emulgent* unto the *Iliaques*. This wind ſeem'd to us to come from the *Left Kidney*, and to inſinuate it ſelf into the *Emulgent Vein*, and thence into the *Cava*. The *Right Kidney* had been removed, ſo that we could ſay nothing of its communication with the ſaid *Ductus*: That ſhall be for another time.

The Queſtion was made, Whether the wind, that ſeem'd to enter into the *Emulgent*, and the *Cava*, did there enter indeed; or, whether it did not ſlide, betwixt the *proper* coat of this Vein, and that *common* one, which comes to it from the *Peritoneum*? This Queſtion did oblige us to ſlit the *Cava* at the place of the *Emulgent*; and then blowing into the *Ductus Thoracicus*, we ſaw, that the wind, which had ſwelled the *Emulgent*, did eſcape at the opening, juſt now made in the *Cava*.

This Experiment made us judge, there was a communication of the *Ductus Thoracicus* with the *Left Kidney*, or at leaſt with the *Emulgent Vein*, in the Body of *this* Woman. And to clear it the more, we made the following Experiment.

2. We lifted with the hand the Lungs, that filled the left Cavity of the *Thorax*, and having cleanſed this Cavity with a Spunge, M. *Gayant* did blow into the *Ductus Thoracicus*, whil'ſt I compreſſed the *Vein* and the *Ductus* with my fingers upon the third *Vertebra*, deſcending from the Back: And we ſaw the wind inſinuate it ſelf under the *Pleura*, by a trace, which raiſed it ſuddenly as often as we did blow. This trace appeared from the 4th *Vertebra* deſcending unto the *Diaphragme*, and made us conclude, that there was under the *Pleura* a Channel of Commerce coming from the *Ductus Thoracicus*, and paſſing to the *Emulgent* Vein by this Cavity of the *Thorax*. We could not doubt, but that this Channel, which paſſed under the *Pleura*, went as far as to the *Kidney*, becauſe we ſaw, that the wind did get in on the ſide of the Kidney into the *Emulgent* Vein, and came out at the hole of the

the *Cava*, that had been made in the first Experiment. We perceived, that this Channel of Communication came from the *Ductus Thoracicus*, at the place of the fourth *Vertebra* of the Back. But to be the surer of it, we made the following Experiment.

3. I compressed with my fingers the *Ductus* upon the *fifth* descending *Vertebra* of the Back; and M. *Gayant* having blown into the Quill, which was upon the *seventh*, the wind passed not to the *Kidney*, nor to the *Emulgent Vein*. Which made us conclude, that the Communication was not beneath the *fifth Vertebra*. Then I compressed with my fingers the *Ductus Thoracicus* and the *Vena Cava* upon the *third* descending *Vertebra*; and the *Emulgent* swelled, when M. *Gayant* blowed into the Quill: Which gave us more strongly to believe, That the place of the *Ductus Thoracicus*, whence goes the Channel of Commerce with the Emulgent, was between the third and fifth *Vertebra* of the Back, as the wind had informed us in the second Experiment.

To be yet more assured thereof, M. *Gayant* split the *Ductus Thoracicus* upon the *third Vertebra* of the Back, and having blown into it at the Quill, the wind came out at the *Axillary* Vein, and the *Ascending Cava*; but the *Emulgent* swelled not at all.

We made a *fourth* Experiment, which seemed very curious to us, and will not be miss to relate here, *viz.*

4. M. *Gayant* having blown into the *Aorta*, whereof all the branches, that had been cut, were tied up, it swelled immediately, and the Emulgent *Artery* grew tumid at the same time: but the wind, that was protruded thorow the Emulgent *Artery* into the *Left Kidney*, returned not into the Emulgent *Vein*; which taught us, that the *Blood* often passeth, where the *Air* does not.

We have an evident proof of it in the *Kidney*, since that the *Blood* of the *Emulgent Artery*, which goes to the *Kidney*, returns thorow the *Emulgent Vein* into the *Vena Cava*, pursuant to the Rules of the Circulation of the Blood; and that the *Air* propelled thorow the *Emulgent Artery* into the *Kidney*, comes not back thorow the *Emulgent Vein* into the *Vena Cava*.

We

We have yet another proof thereof in the *Lungs*, from the Experiment, we made of it in the Aſſembly upon the Corps of a Woman, that was there diſſected in the beginning of *February* laſt; where we ſaw, that the *Air*, which was propelled thorow a Quill into the *Vena Arterioſa* (which is the *Artery* of the Lungs) returned not thorow the *Arteria Venoſa* (which is the *Vein* thereof) into the *Left Ventricle* of the Heart; though, by the Circulation, the *Blood* paſs there with eaſe, and even *Milk*, which having been let in by this *Vena Arterioſa*, returned eaſily thorow the *Arteria Venoſa*, into the *Left Ventricle* of the Heart.

I draw no conſequence from theſe Trials, as to the Channel of Communication, that paſſes from the *Ductus Thoracicus* into the *Emulgent* Vein; becauſe one ought to infer nothing from one onely Body. When we ſhall be certain, that this *Channel of Commerce* is found in *Men*, as well, as we have found it in this Woman, we ſhall then judge better of it. We are therefore going to make frequent Operations upon divers Animals, to ſee whether we ſhall there meet with any thing like it, to the end we may impart it to the Publick.

A Deſcription Of ſeveral Kinds of Granaries, *as thoſe of* London, *of* Dantzick, *and in* Muſcovy.

Concerning the Granaries of London, *the Inquiſitive Dr.* Merret, *(who indeed occaſion'd the Inquiry into the reſt, as a thing, which many were deſirous to be informed about, for the better Preſervation of Grain, in times of its Plenty) gives this Account of them.*

ALl the Twelve Companies of *London*, and ſome other Companies and Private Perſons, have their Granaries at the Bridge-Houſe in *Southwark* (where are a Juſtice of the Peace, a Steward, and two Maſters.) Theſe Granaries are built on two ſides of an *Oblong*; *one* whereof ſtands *North* and *South*, and is near 100 yards long, whoſe Lettice-windows reſpect *North-Eaſt*, the *other* ſide may be about 50 yards long; the Windows look to the *North*,

North, and the oppoſite ſides have no Apertures. All the Windows are about a yard high, without any ſhutters, and run on in a continued *Series*, with very ſmall partitions, ſufficient onely to nail the Lettices to. Each of them is three or four Stories high. The Garret-windows are Jetty-wiſe, with a yards diſtance one from another, glazed out of the Tiles. The Ground or lowermoſt Story, 12 foot from the ground, is uſed onely for a Warehouſe, *&c.* To ſettle the firſt Story upon ſtrong Pillars, fortified with Spikes of Iron, that no Vermin might get up, would make that Story fitter for drying of Corn, and more perflatile; eſpecially where there is no uſe of the lower Rooms. The other Stories, made for Granaries, are in breadth ſome 6 yards, and in height 6 foot or ſomewhat more. The uppermoſt or Garret-Granary to the Top or Angle, made by the raiſing pieces, much more. They have each in the midſt from the ſides at 8 or 9 foot diſtance, a ſtrong Poſt; and all the Timbers made very ſtrong, to ſupport and bear the great weight of the Grain. The Boards beſt made of ſound Oak, two inches thick, and cloſe joynted. In ſome places they put, in all the inſide of their Rooms, Iron-wire, of ſo narrow Meſches, that neither Rats nor Mice can get thorow them, two or three foot deep. Others erect, on all the ſides, Boards of Timber, and faſten others to the top of the Perpendicular, one lying either parallel to the *Horizon*, or ſo that they make an acute Angle with the former, to the ſame purpoſe. For, beſides the devouring of the Grain, the Excrements and Urin of that Vermine, moiſtning the Wheat or Rye, make them apt to corrupt and breed *Weivels*.

The two *main* Conſiderables in building theſe Granaries, are, *To make them ſtrong*, and, *To expoſe them to the moſt drying Winds*.

The Ordering of their Corn is this, In *Kent*, to ſeparate the duſt and other impurities in it, when 'tis thraſh'd, they throw it in Shovels from one ſide to the other, which the longer it is, the better: by which means all ſuch impurities remain in the middle betwixt the two heaps of Corn; which they skreen, to part the Corn, that is good, from the ſaid impurities; then, when they firſt bring the Grain into the Granaries, they lay it about *half a foot* thick, and turn it *twice a week*, and once in that time skreen

it; and this for two Moneths ſpace. After that, they lay it *a foot* thick for two Months more, turning it *once* or *twice* a *Week*, and skreen it proportionably, according as the drying ſeaſon is, ſeldomer or oftner. After 5 or 6 Moneths, they raiſe it to *two foot* in height, and turn it *once* a *Fortnight*, and skreen it once a Moneth, as occaſion is. After *a Year*, they lay it *two and a half or three foot* deep, and turn it *once* in *three* Weeks or a Moneth, and skreen it proportionably.

When it hath lain *two* Years or more, they turn it *once* in *two* Moneths, and skreen it *once* a Quarter, and ſo on, as they find it in brightneſs, hardneſs and drineſs. The oftner theſe two things are done, the better the Grain proves.

They leave an empty ſpace about a yard wide on all ſides of the Room, and at *ſix foot* diſtance, thorow the whole *Area*, empty of Corn; into which empty ſpaces they turn the Corn as often as 'tis needful.

In *Kent* they make two ſquare holes in both the ends of the Floor, and one round in the middle; by which they throw the Corn from the upper into the lower Rooms, *& contra*, to air and dry it the better.

The *Skreens* are made with two partitions, to ſeparate the duſt from the Corn; which falls into a Bag, and when ſufficiently full, is caſt away, the good Corn remaining behind.

Corn has been kept in *London-Granaries*, 32 Years; and the longer 'tis kept, the more flower it yields, in proportion to the quantity of the Corn; and makes the purer and whiter Bread, the ſuperfluous humidity onely evaporating.

Dr. *Pell* mention'd at a Meeting of the *R. Society*, that they keep *Corn* at *Zurich* in *Helvetia*, 80 Years.

So far the Doctor.

As for the Granaries of *Dantzick* and *Moſcovia*, ſome obſerving Merchants and Travellers give this ſhort Account of them.

Firſt, That thoſe of *Dantzick* are generally *Seven* Stories high, ſome, *Nine* Stories; having each of them a Funnel, to let the Corn run down from one Floor to another; thereby chiefly ſaving the labour and charges of carrying it down. And then, that they in

in that Town, are built altogether ſurrounded with water, whereby the Ships have the conveniency of lying cloſe to them, to take in their Lading. No Houſes ſuffered to be built near them, to be thereby ſecured from the caſualties of Fire.

Secondly, That thoſe of *Muſcovy* are made *under Ground*, by digging a deep Pit, of almoſt the Figure of a Sugar-loaf, broad below, and narrow at the top; the ſides well-plaiſter'd round about, and the top very cloſe cover'd with Stone. The people of that Countrey are ſo very careful, to have the Corn well dried, before they put it into thoſe Subterraneous Granaries, that, when the weather of that Northern Climat ſerves not to dry it ſufficiently, they heat their Barns, by the means of great Ovens, and thereby very well drying their Corn, ſupply the deficiency of their ſhort Summer.

Inquiries
For Hungary *and* Tranſylvania.

In proſecution of the Engagement, publiſhed Numb. 23. *p.* 414, 422. *we now ſubjoyn ſome other* Inquiries, *and* firſt *theſe, that were very lately recommended to a ſtudious and inquiſitive* Tranſylvanian, *who from* London *returned to his Countrey, and promiſed to procure good Anſwers to the following particulars*, Viz.

1. WHat is obſervable in *Hungary*, *Tranſylvania*, and the Neighbouring parts, as to Minerals, Springs, Warm Baths, Earths, Quarries, Mettals, *&c.* (*Reference was here given to the Inquiries concerning Mines*, printed *Num.* 19.)

2. *Particularly*, To inquire into the ſeveral ſorts of *Antimony*, or *Antimony-ore*, to be found in *Hungaria*; and to inform us of the ſeveral places, whence they are digged, to the end, that they may be ſent for:

3. To inquire, where the beſt *Hungarian Vitriol* is to be found, and the *Cinnabaris nativa*?

4. To give us a true account of the right *Gold*- and *Silver-Earth*- or *Ore*, ſaid to be found at *Cranach* in *Hungary*; whence the *Gold* is called *Cranach-Gold*, firſt lighted upon by the care of the Emperour *Rudolphus*, and chymically wrought by his order and inſpection?

5. To inquire after, and ſend over ſome of that kind of *Vitriol*, which by credible perſons is affirmed to be found chryſtallized in *Tranſylvania*: As alſo, after the *Vitriol* of *Tyrol*, ſaid to yield *Gold*.

6. To inform us of the *Salt-pits* in *Tranſylvania*, ſaid to yield two ſorts of perfect Salt, the *one* being a *Sal Gemmæ*, the *other*, a common *Table-Salt*. To obſerve how deep theſe *Salt-mines* lie from the ſurface of the Ground? How deep they are digg'd hitherto; and what Damps are met with in them, *&c*?

7. To inquire after the Veins of *Gold* and *Quick-ſilver* at *Cremnitz* in *Hungary*; and the Vein of *Silver* at *Schemnitz* in the ſame Kingdom: And to ſend over ſome of the beſt Ores of them?

8. To inquire, Whether the Waters of the *Thermæ*, that paſs by *Schemnitz*, depoſe a certain ſediment, which in time turns into a yellow Stone?

9. Whether in the Mines of Gold, Silver, Copper, Iron, Lead, in *Hungary*, there be *generally* found *Quick-ſilver* and *Sulphur*?

10. Whether it be true, that in the *Copper-Mines* of the place called *Herren-ground* in *Hungary*, there be found no *Quick-ſilver* at all?

11. Whether it be true, that in ſome parts of the *Upper Hungary*, the Ores of Copper, Iron, and Lead, be ſometimes ſo commixed, that there is often found in the upper part of the Concrete, matter of Iron; in the midſt, matter of Copper, and in the lowermoſt, Lead? And that in other places of the ſame Country, *Copperiſh* fluors are mixed with *Leaden* ones?

12. Whe-

12. Whether it be true, what *Athan. Kircher* writes from Relation, That the *Ductus's* of Mettals do sometimes run *North* and *South*, sometimes Cross-wayes?

13. Whether there be in *Hungary* such a River, as is mentioned in *Busbekius*, whose water is so hot, and which is yet so ful of Fish, that he saith, one would expect, that all the Fish drawn thence, would come out boyled?

14. Whether there be Springs about *Buda* or *Alba Regalis*, that rise at the bottom of the River so hot, that those, who go to bathe, dare not put their feet so low as the Sand, for fear of having them parboyled?

15. Whether there be in *Hungary* an *Avernus*, that exhaleth almost alwayes such poysonous Steams, that Birds flying over it, do often-times fall down, either stupified, or quite dead?

16. Whether the *Iron*, that is said to be turned into *Copper*, by the *Vitriolate* Springs at *Cremnitz* or *Smolnitz* in *Hungary*, do after that *Transmutation* or *Precipitation*, contain a pretty deal of *Gold*?

17. Whether the Depth of the *Gold-Mines* of *Hungary* be 2400 feet?

18. Whether they find Trees, or any other Bodies in the solid Salt of their Salt-Mines.

19. Whether there be a great Lake in *Moravia*, whence of late years all the Waters were by accident drawn away, though formerly carrying Boats, and full of Fish?

30. Whether it be true, what is affirmed by Authors, That in some parts of *Hungary* near the *Gold-Mines*, the Leaves of the Trees have their lower superficies, if not their upper also, gilded over with yellowish Exhalations?

21. What is the way, said to be used in *Austria* and *Hungary*, of extracting the perfect Mettals out of their Minera's *without Lead*; performed by casting a Powder upon the *Minera*, which makes a quick and advantageous separation; Sulphur being supposed to be an Ingredient of it?

Inquiries

Inquiries
For Ægypt, *by* Thomas Henſhaw *Eſq;*

1. WHether it rain there at any time, and if ſo, what time of the Year? Whether Rain make the Air wholſom, or peſtilential, or otherwiſe unhealthful?

2. To conſider the *Niter* that is commonly ſold there, and what affinity there is betwixt *that*, and our *common Saltpeeter*: to try by diſſolving it in warm water, filtring it well, then boyling almoſt half away, and putting the remainder in an earthen Pan, and ſetting it in a cool place for two dayes, to ſee whether it will ſhoot into Chryſtals of *Peeter*. To ſend ſome quantity of it into *Europe*.

3. Whether the Earth of *Ægypt*, adjoyning to the River *Nilus*, preſerv'd and weigh'd daily, keeps the ſame weight, till the 17*th* of *June*, and then grows daily heavier with the increaſe of the River?

4. Whether, if the *Plague* be never ſo great before, yet on the *firſt* day of the *Nile*'s increaſe, it not only increaſeth, but abſolutely ceaſeth, not one dying of it after?

5. To inquire particularly into the manner of *Hatching Eggs* in *Ægypt*; How the *Camel-dung* is prepar'd, wherein they are laid? how often the Eggs are turn'd? how cover'd? Whether they hatch in Twenty one dayes, as they do with us under a Hen? Whether the Chickens be as perfect as ours? If imperfect, Whether that may not happen to them by rough handling, while they are remov'd, being very tender, out of the place where they are hatch'd? To take the deſign of the manner, how by the Pipes the heat is convey'd into ſeveral Rooms. How they treat them betwixt the time of their hatching, and taking away by the Owners? Whether they do not alſo uſe to hatch Eggs under Hens?

6. To

6. To inquire, Whether the great quantity of *Yellow Amber*, which is sold at *Cairo*, be by reason that it is the *Gum* of a certain Tree growing in *Ægypt*, or *Æthiopia*, as *Bellonius* after *Diodorus Siculus* affirms? And whether, besides several Animals that are found inclosed in that *Amber*, there is very frequently some part of the Bark of a Tree found sticking to it?

7. To inquire of a certain Tree, growing not far from *Cairo*, which bears a Fruit stuffed with Wooll, that is finer than Silk, of which the *Arabs* make Linnen that is softer than Silk, and whiter than Cotton?

8. Whether *Crocodiles*, that are found to be sometimes Thirty foot long, are hatched of an Egge, no bigger than a Turkeys?

9. Whether the *Ichneumon*, or *Ægyptian* Water-Rat can kill a *Crocodile*, by skipping into his Mouth, and gnawing his way out, as Old Writers affirm?

10. Whether it be true, That the *Arabs* can Charm the *Crocodiles*; or, Whether there be on the *Nile*'s side any *Talismans*, or Constellated Figures, beyond which the Crocodiles cannot pass, as some would make us believe?

11. To inquire at *Cairo* for several *Drogues*, which are common there, and much in use, yet not brought into *Europe*, as *Acacia*, *Calamus Odoratus*, *Amomum*, *Costus*, *Ben Album*, and divers such others.

12. Whether the *Female Palm-Tree* be not fruitful, unless she grow by the *Male*, as some would bear us in hand?

13. To inquire, Whether the Appearance of the Leggs and Arms of Men, related to stand out of the ground, to a great number, at a place five Miles from *Cairo*, on *Good-Friday*, do still continue? And how that Imposture is performed?

14. Whether Children born there in the *Eighth* Month, do usually

usually live, contrary to what is believed to happen in other Countries?

15. To take an Account of the *Wooden Locks* there, which are said to be made with as great Art, as those of *Iron*, with us.

16. To observe the Course of the Waters, both of the *Mediterranean*, and the *Red-Sea*?

Inquiries For Guiny, *by* Abraham Hill *Esq;*

1. WHether the River *Niger* overflows the Countrey yearly, like *Nilus*?

2. Whether the Rain, when it falls, be often very hot, rotting the Cloaths, if not presently dryed, and breeding Worms in them?

3. Whether the Gold there, be of very different fineness, and that which is uppermost in the Mine be the finest?

4. Whether the *Palm* affords them Wine, Oyl, Vinegar, Soap, Bread; and out of the Leaves they pick Threds, making thereof very curious Works?

5. Whether they have, besides their *Palm-Wine*, a Drink made of *Grain*, like our Ale? What Grain that is, and how prepar'd?

6. Whether their Arrows, they make, be poysonous? By what Tree, and how prepar'd?

7. Whether some People on the River *Gambra*, be only Tawny, as others very Black?

8. Whether the *Negroes* have such sharp sights, that they discover a Ship at Sea much farther off, than the *Europeans* can?

9. What Reason there is to conclude, That the Common People being accustomed to drink VVater, is the cause, that they are troubled with VVorms in their Bodies, very painful to them, and difficult to get out?

FINIS.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, Printer to the *Royal Society*, 1667.

Fig. I.

A Bridge in China.

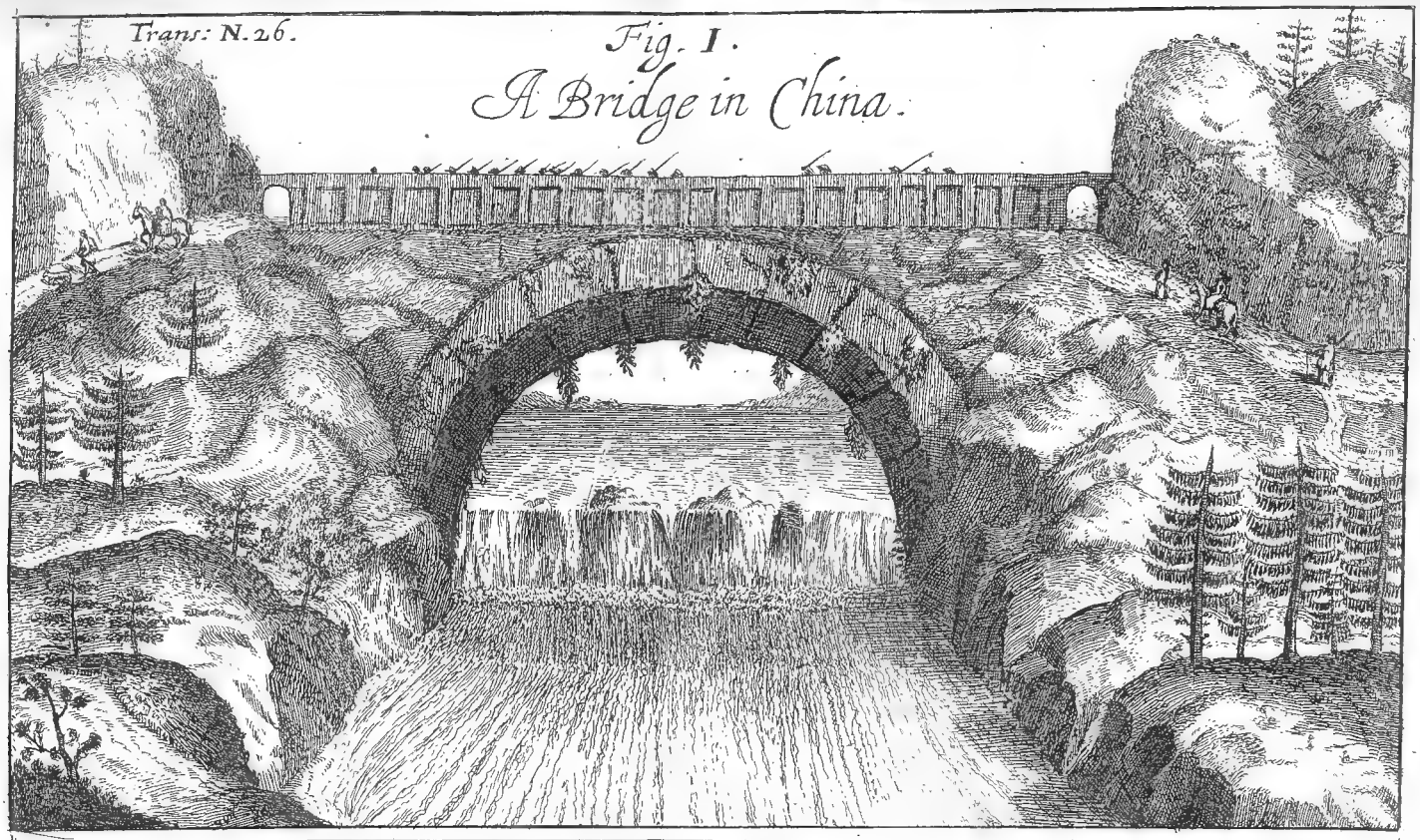
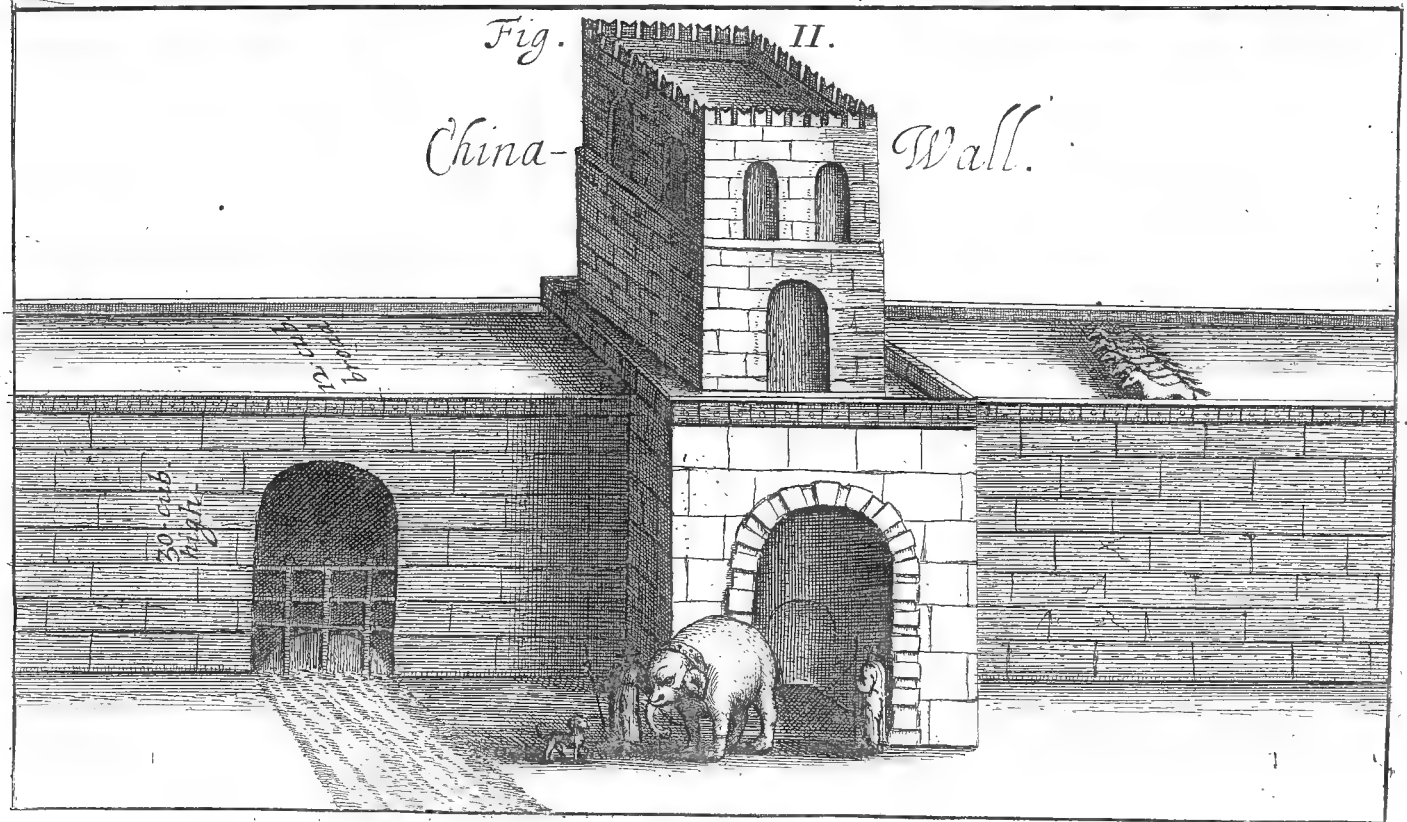


Fig. II.

China-Wall.



PHILOSOPHICAL TRANSACTIONS.

Munday, June 3. 1667.

The Contents.

Experiments for Improving the Art of Gunnery; To find out the Point-blank *distance; the* Quantity *of* Powder, *for the just Charge of any* Peece; *and* what Gun shoots fartheſt. *An Answer to some* Magnetical *Inquiries, formerly publiſhed in these* Tranſactions. *Extract of a Letter from* Paris, *containing an Account of some Effects of* Bloud Transfuſed, *and of two* Monſtrous Births, *&c. A Relation of two other* Monſters, *not long ſince produced in* Devonſhire. *Some Obſervations made in* Mines, *and at* Sea, *occaſioning a Conjecture about the* Origine *of* Wind. *An Account of a* great number *of* Stones, *found in* one *Bladder. The Deſcription of a* Well *and* Ground, *in* Lancaſhire, *taking Fire by a Candle applyed to it. An Account of* Athanaſii Kircheri CHINA ILLUSTRATA.

Experiments for Improving the Art *of* Gunnery.

The better to determine the three Grand Deſiderata, *in the* Art *of* Gunnery viz. 1. *The* Point-blank *diſtance.* 2. *The* Quantity *of* Powder *for the juſt Charge of any* Peece. 3. *What* Gun (*for Size, Bore, Weight, Metal,* &c.) Shoots Fartheſt: *The following Experiments are propoſed and directed, by Sr.* Robert Moray; *to give occaſion to ſuch as are Curious in this Art, to improve the ſame, as they ſhall have opportunity. Who we cannot but ſuppoſe will be ſo generous, as to impart the Succeſſes and the Events of their Tryals of this kind to the* Publiſher *of theſe* Tranſactions; *for further Improvement and Uſe.*

TO Know, how *Far* a Gun Shoots *Point-blank* (as they call it) that is, ſo near the Level of the Cylinder of the *Peece*, that the difference is either not diſcernable, or not conſiderable: On a fit plat-form, place and point the Gun at a Mark, as large as the Bullet, ſome 50. 60. or more Yards diſtant, ſo as the under-ſide of the Mark may be in the ſame Level or 1.

Line with the under-ſide of the Cylinder of the Peece. Then, between the Gun and the Mark at ſeveral places, place pieces of Canvas, Sheets of Paper paſted together, or the like, upon Stakes fixt in the ground, ſo as the under-ſide, being level with the Horizon, may juſt touch the Viſual line, that paſſeth from the Eye to the upper-ſide of the Mark; when the Eye is placed in the Line, that paſſeth from it to the upper-ſide of the Cylinder of the Gun; the Canvas being ſo broad and long, that, if the Bullet paſs through it two or three foot higher than the Level of the Mark, or of either hand, the hole it makes, may make it known, how much it flieth higher than the Level of that place. Such piece of Canvas, *&c.* may be placed; *one*, at half the diſtance between the Gun and the Mark; *another*, half-way between the firſt, and the Mark, *&c.* And if it be found, that even at ſo ſmall a diſtance the Bullet falls lower than the Mark, if it touch not the Canvas, the Gun may be next time raiſed a little, and ſo on, till the Bullet hit the Mark, or as high as it: And if at firſt it fall as high as the Mark and cut the Canvas, the Mark and Canvas may be brought neerer the Gun, till it needs be done no more: Afterwards the Mark may be removed to greater and greater diſtances, till, to hit the Mark, it fly higher, than ſome or all the interpoſed Canvaſſes: And thus the Experiment is to be repeated and varied at pleaſure.

II. To know, what *Quantity* of *Powder*, is the *juſt* Charge of any Peece, ſo as it maketh the fartheſt Shot, and fires totally.

1. Raiſe the Gun to a *mean* Random, as of 20 or 25 degrees, and Shoot with the *ordinary* Charge of Powder, in ſome convenient ground, where the fall of the Bullet may be eaſily ſeen, and having made a Shot, meaſure the diſtance with a Chain, between the hole made by the Bullet, and the Muzzle of the Gun.

2. Then, inſtead of a full Charge of Powder uſed in the firſt Shot, take $\frac{1}{16}$. part leſſe, or ſome ſuch proportion, for the next tryal, doing all things elſe as before.

3. For a third, fourth, or more tryals, diminiſh ſtill the Quantity of Powder by $\frac{1}{16}$. at a time, till the Shot be conſiderably Shorter, than at firſt.

4. Then take $\frac{1}{16}$. more than the firſt Charge, and do all things elſe as before, and ſo continue more tryals, increaſing ſtill the Quantity of Powder in the ſame proportion, every new tryal, till you find the increaſe of the Charge does not make the Peece

Shoot

Shoot further: Only over-Charge not ſo far, as to endanger the Gun.

5. The right Charge found, the beſt Random is to be ſought by trying all Randoms, by degrees at a time.

To know, *What Gun Shoots fartheſt*; III.

1. A Gun, to be prepared of *Culverin-Bore* (as being held the beſt for Shooting far,) but much longer (double the Ordinary length may do well;) is to be placed as in the former Experiments, and charged with the Ordinary Charge of a *Culverin*, or rather with that Quantity, which by the former Experiments ſhall be found the beſt; and being Shot, the fall of the Bullet is to be markt, and diſtance meaſured, as hath been ſuggeſted.

2. Then try leſs, and more Powder in her, as before.

3. Then cut off two inches of the Muzzle with a Saw, and try as before, doing every thing in the ſame manner: And ſo cut off ſtill for new tryals, till the Shot begin to fall ſhorter than before.

4. The ſame may be done with Guns of different Bores.

Advertiſements.

1. The way to accommodate the Canvas, *&c.* propoſed for I. finding out the *Point-blank-diſtance*; is, *firſt* to pitch two ſtakes of the juſt height of the upper-ſide of the Cylinder of the Peece, ſome 6 or 8 foot aſunder, in the ſtreight line between it and the upper-ſide of the Mark, by a long Ruler, having one end in the Peece, after the Peece is duly point at the Mark; and then, by the Eye looking over the Stakes to the upper-ſide of the Mark, or rather by a *Teleſcope*, the Paper or Canvas interpoſed may be let down, or placed juſt ſo, as the undermoſt ſide may ſeem to touch the upper ſide of the Mark, to one that looks at it from the top of the firſt Stake.

2. If this way of Experiment be made for further diſtances and raiſings of the Peece, as high as conveniently may be above the Level, and the diſtances meaſured as hath been intimated; and then all Randoms above theſe likewiſe tryed and meaſured, the diſtance of an Object, to be Shot at, being known, and other neceſſary cautions, beneath to be mentioned, carefully obſerv'd, good Gunners may with great confidence undertake to hit the Mark, be the diſtance what it will, ſo it exceed not the reach of the Gun.

II. 1. The Experiments here propoſed, are to be made in Guns of all *Sizes*, *Bores*, *Weights*, *Metals*, &c.

2. Three or more Shot to be made with every different Charge, and at every ſeveral tryal, that the certainty may the better appear.

3. The firſt Shot being Meaſured and marked, the reſt may all be Meaſured from it, or from one another, to ſave labour.

4. The Gun is to be pointed, placed, and ordered every time in one and the ſame place and poſition, aiming ſtill at the ſame Mark, or pointing ſtill in the very ſame Line or *Azimuth*; that ſo all the Shot may fall in the ſame Line, as near as is poſſible.

5. The Powder muſt be *exactly* weigh'd, every time the Peece is charged, leſt it having been weigh'd long before, the weight may be alter'd; though Experiment may be made with Cartridges and without.

6. The Powder and Bullet is to be rammed home *equally* at *every* Shot; though the looſer the Powder lye, it fire the better.

7. When the *right* Charge of a Peece is found, that makes the fartheſt Shot in the ordinary and plain way of Charging, Monſieur *de Sons* contrivance of a *Wedge* may be tryed, to make it Shoot farther; which is a piece of Board, ſo long, as being thruſt home to the Breech of the Peece at one end, the other may reach farther out than the outſide of the Bullet, being ramm'd up to its place; broad about an Inch, and thin ſo far as the Wadd before the Bullet reaches on the out-ſide; *there* it is to have a Shoulder, from which forward to the end, it is to be cut a ſloap like a Wedge, being of ſuch thickneſs, as that at the place, where the Center of the Bullet is to be, it may make it ſtick ſo faſt, that the Powder finding more reſiſtance may at length drive it out with the greater violence.

8. Another of this nature is a Wooden *Tampion*, like a piece of a Cylinder, big enough to fill the hollow Cylinder of the Gun, the length ſomewhat more than the Diameter of it and hollow'd towards the Bullet, ſo as to fit it; and *either* flat, or (which is better) hollow likewiſe towards the Powder, and ſerving inſtead of a *Wadd*. Theſe and ſuch others will probably render the effect of the Powder greater, than otherwiſe it would be.

9. The *Strength* of the *Powder* muſt be examin'd by a *Powder-Tryer*, that raiſeth a Weight, ſuch an one as has been contrived by Mr. *Hook*, and is made by Mr. *Shortgrave*, Operator to the *Royal Society*.

10. The

10. The Powder uſed in a Set of theſe Experiments, ought to be all of the ſame goodneſs.

11. The ſame Bullet is to be made uſe of, if it can be had, till the Figure of it be marred; otherwiſe another as near of the *ſame* Size, Shape, and Weight, as is poſſible.

12. The ſtrength of the Wind, is to be obſerved at *every* time of Shooting; which may be done by an Engine, made by the lately nam'd *Operator*.

13. Obſerve alſo the Poſition of the Wind, with a Fane and Compaſs at every Shot.

14. Note alſo, at what *Azimuth* the Mark ſtands from the Gun.

15. Take preciſe notice, what effect the Wind hath every time upon the Bullet, in carrying further, in hindering, or turning it aſide.

16. Note the Figure, dimenſions, and Weight of the Gun, Carriage and Wheels.

17. The plat-form to be very Levell.

18. The Wheels to be at every Shot placed in the very ſame place and poſition, to avoid inequalities.

19. Every thing to be *exactly* recorded in a Book, as alſo every Accident and Obſervation.

20. After all other Experiments are made, every Peece may be tryed with the right Charge of Powder, laying every time more and more Weight upon the Carriage; and at laſt fixing the Gun ſo, as it may not recoyle at all, obſerving every time how far the Bullet goes, and how much leſs Powder than the full Charge will ſerve to Shoot the Bullet, when the Peece is fixt, as far as the whole Charge does, when it recoyls freely.

21. Care is to be had, that the Experiments with the *Wedge*, *Tampion*, and the like, made for encreaſing the force of the Powder, and the fixing of the Peece, do not endanger it.

III. 1. The Long Guns are to be made without any *Ring* about the Muzzle.

2. The pieces cut of from the Muzzle, to be alwayes laid on the Carriage, when new ſhots are made, or their weight of Lead in a convenient Figure, that the recoyl may ſtill be the ſame.

3. The Quantity of Powder, that Shoots furtheſt in an *Ordinary Culverin* being known, there needs no Variation of it in the Long one.

Anſwer

Anſwer to ſome Magnetical *Inquiries, propoſed* Numb. 23. *of theſe* Tranſactions, Pag. 423, 424.

The Queries *were theſe.*

1. Whether a *Needle* may be ſo toucht upon any Magnet, as not to point to the true North and South? *&c.*

2. Whether different *Load-Stones*, will give different directions? or, whether fainter or ſtronger touches, upon one and the ſame Magnet, will cauſe any Variation in the directions? *&c.*

To theſe the Induſtrious Mr. *Sellers* returns this Anſwer:

To the *Firſt*; That he had often made tryal with many *Needles* touching them in each *Hemiſphere* of the Stone, with all variety of wayes he could imagine, to find, if it were poſſible by that means to cauſe any of theſe *Needles* to vary in its direction but, that he alwayes found the contrary; all of them conforming to the *Magnetical Meridian*, and ſtanding *North* and *South*, as other *Needles*, that were toucht upon the very *Pole* of the Stone. He *adds*, that ſome of theſe Experiments he tryed in *London*, when there was no Variation known.

To the *Second*; 1. That, upon frequent tryals of touching *Needles* upon different *Load-Stones*, of ſeveral bigneſſes, as alſo of different vertue; the ſeveral *Needles*, touched upon theſe different Stones, gave all of them the ſame directions. This he thinks is confirm'd by all the *Needles* and *Sea-Compaſſes*, made in ſeveral parts of the World, and conſequently touched upon ſeveral Stones of ſeveral Countries, yet all agreeing in this *Magnetical* Harmony, that they all give the ſame directions. 2. That having ſometimes drawn a *Needle*, only over the *Pole* of the Stone, within the Sphere of its vertue, without at all touching the Stone; it hath received the ſame directive quality from the Stone, as if it had been really toucht upon the Stone it ſelf, though not altogether ſo ſtrong, as if it had toucht the Stone. Again, that having toucht *Needles* upon the Stone, with *faint* ſtrokes, and other *Needles* with *ſtronger*; all theſe *Needles* received the ſame effect from the Stone, both for ſtrength and direction; he conceiving, that 'tis not the *fainter* or *ſtronger* touches upon the Stone, nor the *multiplicity* of Strokes, that varies the *Needles* ſtrength or direction; but that the *Nature* of the *Steel*, whereof the *Needle* is made, and the *Temper* that is given thereunto,

thereunto, cauſeth different effects, as to the ſtrength it receiveth from the Stone; himſelf as having tryed all ſorts of *Steel*, that he could poſſibly procure, and all the different *Tempers* he could imagine, for the moſt powerful receiving and retaining the vertue from the *Load Stone*; wherein he affirms to have fully ſatisfied himſelf, ſo that he can infuſe ſuch vertue into a piece of *Steel*, that it ſhall take up a piece of Iron of two *Ounces* weight or more; and give alſo to a *Needle*, the vertue of conforming to the *Magnetical Meridian*, *without the help of a Load-Stone*, or any thing elſe, that hath received vertue therefrom.

So far this Anſwerer; whom as we cannot but much commend for his diligence in ſearching, and frankneſs of communicating; ſo we give theſe particulars to the publick, that further Tryals may be made by others, for more diſcovery; hoping withall, that the ſame Inquiſitive perſon, that hath made theſe returns, will not ſcruple to add to them the wayes, he uſes for infuſing that *Magnetical* vertue into *Steel* and *Needles*, without the help of a *Load-Sone*, ſpoken of in the end of this his *Anſwer*.

Extract of a Letter, Written from Paris, *containing an Account of ſome Effects of the* Transfuſion *of Bloud; and of two Monſtrous Births*, &c.

I was preſent, when *M. Gayant* ſhew'd the Transfuſion of the Bloud, putting that of a Young Dog into the Veins of an Old, who, two hours after, did leap and friſk; whereas he was almoſt blind with age, and could hardly ſtirr before.

In the Houſe of *M. Bourdelots* was ſhew'd a Monſter in form of an Ape, having all over its ſhoulders, almoſt to his middle, a maſs of fleſh, that came from the hinder part of its head, and hung down in form of a little Cloak. The report is, that the Woman that brought it forth, had ſeen on a Stage an Ape ſo cloathed: The moſt remarkable thing was, that the ſaid maſs of fleſh was divided in four parts, correſpondent to the Coat, the Ape did carry. The Woman, upon inquiry, was found to have gone five months with Child, before ſhe had met with the accident of that unhappy ſight. Many queſtions were on this occaſion agitated: *viz.* about the Power of Imagination, and whether

whether this Creature was endow'd with a humane Soul; and if not, what became of the Soul of the Embryo, that was five months old.

A little after, another Monſter was produced, which was an Infant come to maturity, having inſtead of a Head and Brains, a Maſs of fleſh like any Liver; and was found to move. And this *Fætus* occaſioned a Queſtion for the *Carteſians*, how the motion could be performed, and yet the *Glandula pinealis*, or *Conarium* be wanting; nor any Nerves viſible, which come from the Brain? The marrow in the *Spine* was of the ſame ſubſtance. It liv'd four days, and then dyed: It was anotomized by *M. Emmerez* in preſence of the Aſſembly.

There came a Letter from *Florence*, Written by *M. Steno*, which has alſo ſomewhat perplext the followers of *Des Cartes*. A Tortoiſe had its head cut off, and yet was found to move its foot three days after. Here was no Communication with the *Conarium*. As this ſeems to have given a ſore blow to the *Carteſian* Doctrine, ſo the Diſciples thereof are here endeavouring to heal the Wound.

An Account of two Monſtrous Births, *not long ſince produced in* Devonſhire; *communicated by M.* Colepreſſe.

1. One *Robert Cloak* a Joyner (whom I know) of *Clamick* in the Pariſh of *Beer-Ferris* in *Devonſhire*, had on *Febr.* 24. laſt, a Monſtrous *black* Ram-Lamb fallen with one Head, but two diſtinct Bodies, with eight Legs; which Bodies were joyned in the Neck: It had two Eyes, and as many Ears, in the uſual places; and one extraordinary Eye in the Niddock, with one ſingle Ear, about an inch diſtant from the Eye backwards: Its Dame, which was *White*, uſually brought forth two Lambs every year, as ſhe did this year alſo a *White* one, which with the Ewe remains alive. But whether this Monſter was produc'd dead or alive, is not known, it being found dead by the hedge, and ſoon after put into the Earth. There were ten *White* Ews accompanied with three *White* Rams.

2. One *John Cauce*, Servant to *Mr. William Knighton* of *Lockridge*, likewiſe in *Beer Ferris*; had among his Sheep, on the ſeventeenth of *Febr.* laſt, a *White* Lamb faln on a Common in the ſaid Pariſh, with two diſtinct heads and Necks, Joyned at the Shoulders

ſhoulders, but one only Body, and that well form'd, yet having double entrals in all reſpects. The Ewe remains well. The Monſter dyed, and is now in my Cuſtody, after it hath been dried in an Oven, and by the Sun.

Some Obſervations made in Mines, *and at* Sea, *occaſioning a Conjecture about the* Origine *of* Wind: *Imparted by the ſame Mr.* C.

One *John Gill*, a Man well experienced in Mineral affairs, diſcourſing with me about the Wind and its Origine; declared to me his thoughts concerning the ſame, as a reſult of twenty years Experience and Obſervations of his own.

Firſt, He affirmed, that if in digging deep under ground, the Work-men meet with Water, they never want Air or Wind; but if they miſſe Water (as ſometimes it happens, even at 12 or 16 Fathoms depth) they are deſtitute of convenient Air, either to breath in, or to make their Candles burn.

Next, When (as uſual) there happens to be a great quantity of a Winters ſtanding water, in a deep Mine, they commonly bring, or drive up an *Adit* for drawing away ſuch water: But as ſoon as that part of the Level is made, that any of the ſtanding Water begins to run away, the Men muſt ſecure themſelves, as well as they can, from danger of being daſh'd in pieces againſt the ſides of the *Adit*: For the included Air or Wind in the ſtanding Water, breaks forth with ſuch a terrible noyſe, as *that* of a Peece of Ordnance, and with that violence, as to carry all before it, looſening the very Rocks, though at ſome diſtance in the Work or *Adit*.

Thirdly, he hath obſerved on ſeveral occaſions, going to and fro, between *London* and *Plimouth*, by Sea, that being in a Calm, that way, which the Sea began to Loom or move, the next day the Wind was ſure to blow from that point of the Compaſs, towards which the Sea did Loom the day before.

An Account of Hail-Stones *of an unuſual bigneſs, Communicated by* D. Nath. Fairfax, *with his Reflections on them.*

This Account came but very lately to hand, though the thing hapned a while agoe; the Ingenious Author thereof, having but newly entred into a Philoſophical *Correſpondence with the* Publiſher.

July, 17. 1666. About 10 in the Fore-noon, there fell a violent

ſtorm of Hail about the Coaſt-Towns of *Suffolk*, tracing along *Seckford-Hall*, *Wood-bridge*, *Snape-bridge*, *Aldborough*, &c. more to the North-ward. The Hail was ſmall near *Yarmouth*; but at *Seckford-Hall*, one Hail-ſtone was found by meaſure to be 9. *Inches* about. One of this Town (*viz. Wood-bridge*) found one at *Melton*, 8. *Inches* about. At *Snape-bridge* a man affirm'd, that he lighted on one about 12. *Inches* about. A Lady of *Friſton-Hall*, putting one of them into a Ballance, found it weigh 12 *s.* 6 *d.* Several perſons of good credit in *Aldborough* affirm'd, ſome Hail-ſtones to have been full as bigg as Turkeys-Eggs; (an ordinary Hens-Egg weighs but about 9 *s.*) *J. Baker* of *Rumborough*, driving a Cart on the Heath by *Aldborough*, had his head broken by the knocks of them through a ſtiff Country-felt: In ſome places his head bled; in others, bunnyes aroſe: The Horſes were ſo pelted, that they hurried away his Cart beyond all command. They ſeem'd all *white*, ſmooth without, ſhining within. 'Tis ſomewhat ſtrange, methinks, that their pillar of Air ſhould keep them aloft, if they were not clapt together in the falling; eſpecially at ſuch a time of the year, when the Air is leſs thickned and its Spring weaker.

Account of a great number of Stones, found in one *Bladder, by the ſame.*

Mr. *Goodrick* Chirurgeon of *Bury* St. *Edmunds* affirm'd to me, that himſelf Cutting a Lad of the Stone (for which he hath a great name) took out thence, at one time, 96 ſmall Stones, all of them of unlike ſhape, Size, Corners, Sides; ſome of which were ſo beſtow'd as to ſlide upon others, and had thereby worn their flats to a wonderfull ſlikneſs. He aſſur'd me alſo, that in the ſame place, another, when dead, had a Stone taken from him, almoſt as big as a new-born Childs head, and much of that Shape.

The Deſcription of a Well, and Earth in Lanchaſhire, *taking Fire by a Candle approached to it.*

This was imparted by that Ingenious and Worthy Gentleman, Thomas Shirley *Eſq; an Eye-witneſs of the thing, now to be related in his own words;* viz.

About the later end of *February* 1659. returning from a Journey to my houſe in *Wigan*, I was entertained with the relation of an odd Spring, ſcituated in one Mr. *Hawkley's* Ground (if I miſtake

ſtake not) about a mile from the Town, in that Road which leads to *Warrington* and *Cheſter*.

The people of this Town did confidently affirm, that the Water of this Spring did burn like Oyle; into which Error they ſuffered themſelves to fall for want of a due examination of the following particulars.

For when we came to the ſaid Spring (being five or ſix in company together) and applyed a lighted Candle to the ſurface of the Water; 'tis true, there was ſuddenly a large flame produced, which burnt vigorouſly; at the ſight of which they all began to laugh at me for denying, what they had poſitively aſſerted: But I, who did not think my ſelf confuted by a laughter grounded upon inadvertency, began to examine what I ſaw; and obſerving, that this Spring had its eruption at the foot of a Tree, growing on the top of a neighbouring Bank, the Water of which Spring fill'd a Ditch that was there, and covered the burning place lately mention'd; I then applyed the lighted Candle to divers parts of the Water, contained in the ſaid Ditch, and found as I expected, that upon the touch of the Candle and the Water, the Flame was extinct.

Again, having taken up a diſhfull of Water at the flaming place, and held the lighted Candle to it, it went out. Yet I obſerved that the Water at the burning place did boyle, and heave like Water in a Pot upon the Fire, though my hand put into it perceived it not ſo much as warm.

This boyling I conceived to proceed from the Eruption of ſome bituminous or ſulphureous Fumes; conſidering, this place was not above 30 or 40 yards diſtant from the mouth of a Coal-pit there. And indeed *Wigan*, *Aſhton*, and the whole Country, for many miles compaſs, is underlaid with Coal. Then applying my hand to the ſurface of the Burning place of the Water, I found a ſtrong breath, as it were a Wind, to bear againſt my hand.

Then I cauſed a *Dam* to be made, and thereby hindering the recourſe of freſh water to the Burning place; I cauſed that, which was already there, to be drained away; and then applying the burning Candle to the ſurface of the dry Earth at the ſame point, where the Water burned before; the Fumes took fire, and burn'd very bright and vigorous. The Cone of the Flame aſcended a foot and a half from the Superficies of the Earth. The Baſis of it

was of the Compaſs of a Mans hat about the brims. I then cauſed a Bucket-full of Water to be poured on the fire, by which it was preſently quenched, as well as my companions laughter was ſtopped, who then began to think, the Water did not burn.

I did not perceive the Flame to be diſcolour'd, like that of ſulphureous Bodies, nor to have any manifeſt *ſcent* with it. The Fumes, when they broke out of the Earth, and preſt againſt my hand, were not, to my beſt remembrance, at all hot.

Account of Athanaſii Kircheri *CHINA ILLUSTRATA.*

The *Author* by publiſhing this *Volume*, diſcharges the Promiſe, he had made ſome years ago, that he would do ſo. He acknowledges himſelf much obliged to *Martinius*, and his *Atlas Sinicus*; as alſo to *Michael Boim*, a *Polonian*; *Philippo Marino*, a Jeſuit of *Genoa*; and two other of the ſame Society, *viz.* *Henry Roth* of *Auſburg*, and *John Gruber*, an *Auſtrian*; whereof the latter went A. 1656. over *Land* from *Rome*, through *Anatolia*, *Armenia*, *Perſia*, *Ormus*, *Cambaja*, and *India*, to *Macao*, the famous Port of *China*, and thence to *Pekin*, the Court of that Empire; whence two years after, he came back to *Rome*, accompanied for a part of the way, by the Jeſuit *Albert Dorville*; traverſing by Land in a manner the whole breadth of *China*, and a great part of the confining *Tartary*, and ſo further, through the *Mogols* Dominions, to *Agra*, where the ſaid *Dorville* dying, the above-mentioned *Henry Roth* ſupplyed his place in accompliſhing this Voyage.

The Book it ſelf, a large *Folio*, is divided into 6. Parts.

The *three* firſt, and the *laſt*, being beſides the deſign of theſe Tracts, we ſhall but glance at, taking only notice; *Firſt*, That they pretend to perſwade the Reader, that *Chriſtianity* was ſpread over all *Aſia* by St. *Thomas* the Apoſtle, and his Succeſſors; and hath been there continued, though not without great *Eclipſes*, to theſe very times. And here the *Chino-Chaldæan Monument*, ſaid to have been erected ſeveral hundred years ſince in *China*, and found out A. 1625. is with great labour aſſerted and interpreted. *Next*, That the Riſe of the Idolatry, in thoſe remote parts, and their different Ceremonies in Worſhip, is confronted with thoſe Ancient ones of *Egypt*. *Laſtly*, that a large Account is given of the *Chineſe* Letters, their Figure, Power, *&c.*

But we haſten to the *Fourth* Book, as belonging to our Sphere.

That

That undertakes to describe the *Curiosities* and *Productions* of *Nature* and *Art*, in *China*. Here, the Author having premised something of the advantagious Scituation of *China*, and its *Political* Government; Calculated also both the Number of its Inhabitants, (which according to him, amount to 200 Millions of Men, besides Women, Children, Officers, and Eunuchs;) and the *Annual* Revenue of the Emperour (which he makes to be 150 Millions of Gold-Crowns;) he relateth many considerable productions and works of Nature in that Country; As

1. *Mountains* very odd for shape, burning, and raising of Tempests.

2. *Isles*, to the number of 99. all turned into one, under the same extent of space they had, when they were divided by water.

3. *Lakes*, some changing Copper into Iron, and causing storms, when any thing is cast into them; and others, sprung up by Earth-quakes.

4. *Rivers*, whereof one is said to be of a *Blew* colour in Autumn, and for the rest of the year *Limpid*: Another, to be cold at the top, and very hot beneath.

5. *Fiery Wells*, serving to boyl meat over: Perhaps of the same Nature with that here in *England*, we described above.

6. *Plants*, as 1. some Roses, changing their Colour twice a day: Whence the *Author* takes occasion to speak of that Plant, which grows at *Rome*, in the Garden of one Signior *Corvino*, call'd *Viola Nocturna*, changing its colour sensibly, according to the degrees of the rising and declining of the Sun; destitute of all smell in the day-time, but having a very fragrant one in the night. 2. A Farinaceous or *Mealy* Tree, serving to make Bread of it. 3. *Leaves* of certain Trees, standing on the side of a Lake, which falling into the water, become like black *Birds*: which he ascribeth to the Seminal parts of some Eggs, broken on those Trees, fill'd with Birds nests. 4. *The*, and its wholesomeness, as to the suppressing of Vapours, and preventing the Stone. 5. A kind of *Wicker-Tree*, which, as if it were a Rope twisted by Nature, about an inch thick, creeps along upon the Earth, sometimes the length of 120 paces, much embarassing the way; but serving for Cables to Ships, Seats, Hurdles, Beds, Matts; enduring no Vermin; and being cool and refreshing in hot Seasons. 6. The *Calamba-Wood*; that it is esteem'd by some to be a kind of *Len-*

tiscum

tiscum, by others, a sort of *Terebinth*, but of a nobler rank, by vertue of that Climat: which makes the Author suggest, that care should be taken to have it brought into *Europe*, and carefully cultivated there. 7. *Rhubarb*; of which he observes, that, because the vertue of its Roots, if they be exposed to dry hastily, soon evaporats; therefore the skilfull, lay them upon a Table within doors, and turn them several times a day, to incorporate and fix the Juyce the better, and then string them and expose them to the Wind, in a shade, altogether free from the Sunbeams. 8. *Pine-Trees*; of which he saith some are so big, that eight Men can hardly Fathom them. 9. *Canes*, so big, that they can make as many Barrels of them, as they have internodes or Joynts. 10. Trees, sweating a *Gum*, call'd *Cie*, like the droppings of *Turpentine*; which Gum, as long as tis not dryed, emits a very unwholsome and dangerous steam. To passe by the *Polonie* Tree, producing fruit without any blossoms, immediately out of its Trunk, as big as one man can well carry; and that kind of *Fig-Tree*, that bears Leaves as big as to wrap up a man in, *&c.*

7. *Animals*, Here he discourseth of the *Musk Dear*, and the several Compositions of *Musk*: the *Sea-Horse*, and *Wild Men*: Of some *Birds*, no where seen but in *China* (as he thinks) and among them a *Wool-bearing Hen*: Of *Fishes*, in Summer flying out of the Sea, seeking their food, like *Birds*, and in Autumn returning to the Sea: particularly of a Fish of a very exquisite taste, called *Hoancio-yu*, or the *Croceous* Fish: Further, of *Sea-Cows*, going often ashore, and fighting with the *Land-Cows*: Of *Bats*, of a vast bigness, eaten by the *Chinese* as a delicious meat: Of the *Serpent*, that breeds the *Antidotal* stone; whereof he relates many experiments, to verifie the relations of its vertue: Which may invite the *Curator* of the *Royal Society*, to make the like tryal, there being such a stone in their *Repository*, sent them from the *East Indies*. Again, of *Silk Worms*, spinning *twice* a year, and yielding a double *Crop*.

8. *Fossils*, where occurs the Relation, 1. Of an odd *Specular* stone, representing the figure of the Moon in all her Appearances, when exposed to Her. 2. Of an *Earth* called *Quei*, very Cosmetick, and absterstive of all blemishes of the face. 3. A *Mineral ceruse*, blended of Lead and Antimony. 4. Of *Asbestus*, that can be drawn and spun; the way of which he affirms to have described L. 12. *Mundi sui subterranei*. 5. The *Matter that makes Porcellan*, which he affirms to be nothing else but a transparent Sand,

which

which they ſoak in water, and then reduce to a Maſſe or Dough, and ſo bake it. Not a word of the way of giving it the colour, which, it ſeems, they keep as a great ſecret. They have *Gold* and *Silver Mines*, but dig them not, pretending the danger and trouble in the work, and contenting themſelves with the Filings and Duſt of Gold, which they gather out of the Mud and Sand of Rivers and Fountains.

The *Fifth* Book contains an account of their Works of *Architecture*, and other ingenious Mechanick Arts. Where he ſpeaks, 1. Of their ſtupendious *Bridges*, one of 360 Perches long, and 1 ½ Perch broad, without any Arch, ſtanding upon 300 Pillars, with acute Angles on both oppoſite ſides, all the ſtones being of an equal ſize and ſhape. Another, built from Mountain to Mountain by *one* only Arch, 400 cubits long, 500 cubits high (whence tis called *Pons volans*) from the ſurface of the *Saffrany* River, running under it. This is repreſented, for the ſatisfaction of the Curious, by *Figure I.* *Fig. I.*

2. *Vaſt Towns*, but whoſe Houſes are generally but one Story high, and good reaſon therefore, the Towns ſhould be very big. They are, for the moſt part, built of Timber.

3. *Turrets* very artificiall, whereof one is all of *Porcellan.*

4. The *China Wall*, 300 German Leagues long; 30 Cubits high, 12 (in ſome places 15) Cubits broad, ſo that 12 Horſes can very conveniently go in front on it; built 215 years before *Chriſt*, by the Emperour *Pius*, a brave and moſt Warlike Prince, and diſpatcht in the ſpace of five years; commonly it is defended by a Million of men. A Pattern of this alſo was thought fit to exhibit here, by *Figure II.* *Fig. II.*

5. The *Channel*, that paſſeth from one extream of *China* to the other, having ſome 24 *Sluces*, to retain water, when tis neceſſary; a work of incredible induſtry and extraordinary advantage.

6. *Vaſt Bells*, one whereof, at *Pekin*, weighs 120000 pounds; whereas that of *Erfurd* in *Germany*, hitherto eſteemed to be one of the biggeſt in the World, weighs but 25400. pounds.

As for their ingenious Inventions, *this Author mentions chiefly,*

1. Their *Vernice*, of which he ſets down ſome *Receipts* both for the *Red* and *Black*, together with the way of their Uſe and Application, as he received them both from an *Auguſtinian* Fryar; affirming, that it differs not at all from that of *China*.

2. Their way of *Printing*, invented long before that in *Europe*, giving a large deſcription of the ſame.

3. *Gun-*

3. *Gunpowder*, which he alſo ſaith, they had before the *Europeans*.

4. *Bell-founding*.

Theſe are the principal Subjects treated of in this Book. We paſſe by ſeverall Stories, which ſeem much to require confirmation. *E. g.* That of *Sugar-Canes*, eaten by an Elephant, and taking root in his ſtomach; that of Boys eating Serpents with as much greedineſs, as others eat Eels, or any good meat, *&c.*

Among the *Cutts* of this Volume, there is a *Map* of *Aſia*, not un-inſtructive; delineating the way, the two *Jeſuits* took in their Land-voyage from *Pekin* to *Goa*; as alſo that, which the *Muſcovian* Ambaſſadors, not many years ſince, took in travelling from their Countrey, through the vaſt Tract of the Northern *Tartary*, to *China*, arriving on the *North ſide* of the *China Wall* at *Pekin*: *Item*, The Land-paſſage, heretofore made by *B. Goes* (deſcribed by *Rigaultius*) from *Perſia*, by *Lahor* in the *Mogols* Empire, through the Kingdoms of *Cabul*, *Zancut*, *&c.* to *Cataja*, or (which is all one to this *Author*, as it is to ſeveral others) the Province of *Pekin* in *China*. *Item*, The paſſage of *Paulus Venetus* over Land, out of *Europe* into the ſame *China*: and laſtly, That pretended one of St. *Thomas*, out of *Paleſtina*, through *Syria*, *Meſopotamia*, *Perſia*, the *Mogols* Empire, the *Pen-inſul* between the Bays of *Cambaya* and *Bengala*, to *Maliapur*, on the Coaſt of *Coromandel*, where the Name of the *Chriſtians* of St. *Thomas* is ſtill in requeſt.

LONDON,
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A LETTER

Concerning a new way of curing ſundry diſeaſes by Transfuſion of Blood, Written to Monſieur de MONTMOR, *Counſellor to the* French King, *and Maſter of* Requeſts.

By J: DENIS *Profeſſor of* Philoſophy, *and the* Mathematicks.

Munday July 22. 1667.

SIR,

THE project of cauſing the Blood of a healthy animal to paſſe into the veins of one diſeaſed, having been conceived *about ten years agoe*, in the illuſtrious Society of *Virtuoſi* which aſſembles at your houſe; and your goodneſs having received M. *Emmeriz*, & my ſelf, very favorably at ſuch times as we have preſum'd to entertain you either with diſcourſe concerning it, or the ſight of ſome not inconſiderable effects of it: You will not think it ſtrange that I now take the liberty of troubling you with this Letter, and deſign to inform you fully of what purſuances and ſucceſſes we have made in this Operation; wherein you are juſtly intitled to a greater ſhare than any other, conſidering that it was firſt ſpoken of in your *Academy*, & that the Publick is beholding to you for this as well as for many other diſcoveries, for the benefits & advantages it ſhall reap from the ſame.

But that I may give you the reaſons of our procedure & con-

vince you that we are not culpable of the raſhneſs wherewith we may poſſibly be charged: be pleaſed to permit me to relate to you in few words the reaſons alledg'd by ſome perſons, to oppoſe our deſign, and to compare the ſame with thoſe which engag'd us to execute, and by certain degrees carry it on to that perfection wherein it is at preſent.

You have heard of the tryal we made about four moneths agoe upon Dogs, to tranſmit the Blood of the *Crural Artery* of one into the *Jugular Vein* of another. And being this operation even at the firſt attempt ſucceeded as happily as we could wiſh, according as it is more at large ſet forth in the *Journal des Sçavans*, of *March* laſt; we were encouraged to repeat the ſame ſeveral times both in publick and private, and we added ſo many circumſtances to the manner of performing it, that its eaſineſs ſeemed to invite us not to neglect it, but to make abundance of Obſervations which might be of ſome benefit in Practice.

Accordingly, We afterwards made the Transfuſion ſeveral waies, ſometimes from an *Artery into a Vein*, ſometimes from *one Vein into another*, both in thoſe of the Neck, and thoſe of the Leg; in Dogs both weak and ſtrong, great and ſmall; as alſo in ſuch as had already either received or communicated blood in former transfuſions. And not finding one of nineteen to die, but on the contrary alwaies obſerving ſome ſurpriſing effect in all ſuch as had received new blood, we were ſtrongly perſwaded that the transfuſion would have no ſuch dangerous conſequences, as ſome people endeavor'd to preſage.

Wherefore we reſolv'd to drive the buſineſs yet a little further, and not contented to have ſeen it happen well in ſubjects of one and the ſame ſpecies; we thought good to try it in ſome of a different ſpecies, and accordingly we took a Calfe and a Dog; becauſe we conceiv'd the blood of theſe Creatures altogether diſſimilar. In your preſence we tranſmitted a *Calfs blood, into a Dogs Veins*, on the 28. of *March*; ſince which time we have alſo done the ſame upon other occaſions, alwaies adding ſomewhat new towards the facility of the Operation.

ration. Yet in all theſe Experiments we never could obſerve any indiſpoſition in the Dogs which receiv'd the Blood; whence we became confirm'd in the Opinion, that there was more ground to hope effects rather advantageous than hurtful to mankind, from this diſcovery of Transfuſion of Blood.

Nevertheleſs, that we might vent nothing unadviſedly, we publiſht theſe Experiments, and were well pleaſed to underſtand the judgment of the ableſt Philoſophers and Phyſitians, upon the matter we examin'd, whether any of them had reaſons weighty enough to diſſuade us from carrying on our tryals even in Man; and I beſeech you permit me to ſum up the principal here which are come to my knowledge, and judge your ſelf whether they ought to have ſtopt us, and whether we deſerve praiſe or blame for having proceeded further. Some have attaqu'd this deſign by decrying it as Chymerical & impoſſible. 1. Becauſe the diverſity of Complexions (which is founded in the Blood) ſuppoſeth ſo great a diverſity in the ſeveral Bloods of different Animals, that 'tis impoſſible but one muſt be Poyſon and Venome in reſpect of another. 2. Becauſe Blood entravaſated or remov'd out of its natural place, muſt neceſſarily corrupt, according to the dictate of *Hyppocrates*. 3. Becauſe the Blood iſſuing out of its proper Veſſels, and being to paſs through inanimated conveyances, ſuch as are the Pipes or Tubes employ'd in the Transfuſion; it muſt infallibly coagulate, and ſo coagulated deſcending to the heart muſt cauſe there a Palpitation, whereof death will be the ſpeedy conſequent.

Theſe Reaſons have not appear'd to us of great importance. For as to the firſt, we acknowledge that there are as many different complexions and various qualities in the blood, as there are Individuals in every Species: But we believe it not concluſible from thence, that the Blood of one muſt be Poyſon in reſpect of others; no more than it follows, that all the Meats wherewith we are nouriſht, and whereof our Blood is only an Elixir or Quinteſſence, muſt corrupt and poiſon the ſame, becauſe they are endu'd with qualities differing from

thoſe of the Blood. On the contrary, as 'tis certain that cooling Meats or Medicaments ſerve to temper the heat of the Blood when it boiles in the Veines, and hot food or Phyſick excite new vigour in ſuch blood, as old age or a Diſeaſe hath render'd torpid and coagulated in the Veſſels; ſo 'tis as reaſonable to infer, that great advantages will follow upon the mixture of different bloods, provided the ſame be directed and manag'd by the ordinary prudence of able Phyſitians; and that if a hot Blood can reinfuſe new ſtrength into that which languiſheth with coldneſs, ſuch blood as hath colder qualities, may alſo check the Ebullitions and Tumults of that which is overmuch chafed.

As for the authority of *Hippocrates*, who ſaith that extravaſated blood corrupteth, It is no wiſe repugnant to our pretenſions. For to ſalve the honor of that great Perſon, his meaning muſt be rightly expounded, which is no more but this; that the Blood neceſſarily corrupteth when it is out of the Veſſels, which preſerve its heat, and which permit it a natural motion and free circulation, whereby it purifieth it ſelf continually. For example, being extracted into a diſh, wherein all its parts are ſtopt and coagulated, it muſt in a little time alter its conſtitution, as experience witneſſeth. Nor doth this hinder but that it is alſo corrupted ſometimes in its own place, contrary to that Aphoriſme, *Quicquid corrumpitur, in loco alieno corrumpitur*: For if its motion be interrupted in the Veines either by ſome obſtruction form'd therein, or ſome diviſion occaſion'd by a Wound or Contuſion, it cortupteth in a ſhort ſpace and degenerateth into purulent matter. But in this Experiment of Transfuſion, the Blood is communicated in ſuch manner, and paſſeth out of one animal into another, that 'tis impoſſible its natural motion ſhould be interrupted. 'Tis true it paſſeth through unnatural Conduits, but theſe being once warmed and admitting no air into their cavities, they cauſe no more alteration in the Blood than the Arteries and Veines themſelves do.

Moreover, ſuch as conceive that the blood Transfuſed, muſt

muſt needs coagulate by the way and afterwards cauſe ſome mortal palpilation; they foreſee an accident which never hapned to us, and againſt which I deſire no other ſecurity than the experience we have had of all the animals hitherto employ'd by us, which are ſtill living.

Others who have either been witneſſes of ſome of our Tranſfuſions, or have underſtood the ſame from credible relators, diſpute not the poſſibility of the thing: but yet not to authorize appears new, they ſay, That whatſoever care and caution be uſ'd in the Tranſfuſion, it can never be practiſ'd upon Man with ſucceſſe; and theſe are their principal Reaſons.

Firſt, The blood of a ſound, and the blood of a diſeaſed body having qualities very different, the one being pure, the other impure, a perfect mixture thereof cannot be effected; they are two contraries, which will be at perpetual fewd, the iſſue whereof can be no other but the ruine and deſtruction of the ſubject on whom the experiment is attempted. I wiſh thoſe that diſcourſe thus, firſt underſtood but what they endeavour to perſwade others of; and that they would explaine to us what artifice they fancy in the Veins and Arteries, to give paſſage to one ſort of blood & exclude another at the ſame time. For my part I confeſſe I cannot comprehend why the continual circulation and rarefaction made in the heart by the heat of its Ventricles, are not more than ſufficient to make a perfect mixture there of theſe two ſorts of blood, & the difficulty ſeems the greater in regard experience appears to flatter me into a contrary opinion. For having a few dayes agoe ſyring'd about a quarter of a pinte of Milk into the veins of an Animal, and having opened the ſame ſome time after, we found the Milk ſo perfectly mixt with the whole ſubſtance of the blood, that there was not any place wherein appear'd the leaſt footſtep of the whiteneſs of Milk, and all the Blood was generally more liquid and leſs apt to coagulate.

The ſecond Objection of the ſame Author is, That ſhould the pure Blood mingle with the impure, yet it would not long

long preſerve its Purity and temperament; in regard that upon its Arrival at the Liver (which is the grand Organ of Sanguification wherein the blood receives all its qualities) it would infallibly loſe all its goodneſs, and in an inſtant become like the whole Maſſe, which we ſuppoſe corrupted; and conſequently can produce no benefit therein by its mixture.

But this Objection is ill enough grounded, ſince it ſuppoſeth the blood to be made in the Liver, and is contrary to experience which demonſtrateth moſt evidently, both the exiſtence of blood in Animals before the formation of the Liver, and alſo the Arrival of the Chyle, and at the heart, and converſion of the ſame into blood there, before it entreth into the Veines which carry it to the Liver: wherefore I diſmiſs this reaſon and proceed to another, which ſeemeth ſtronger and is offer'd by perſons more judicious.

'Tis not conteſted in this Objection in what place ſanguification is perform'd, becauſe 'tis held to be done in ſeveral parts of the body, namely by reiterated circulations in the heart, Veines and Arteries: But 'tis likewiſe maintain'd that all theſe parts come either by ſickneſs or age, to a certain degree of intemperature and malignity, from which there is no poſſibility to recover them; and that in this ſtate they have power to communicate their evil qualities to whatſoever approacheth them; whence conſequently in a little time they corrupt the laudable blood, wherewith they are newly irrigated. Proof of this is afforded both by example and experience. The example is taken from a *Hogſhead* of *Vinegar*, which being once throughly imbu'd with that *Liquor*, is no longer fit to contein any other, but every thing pour'd thereinto is immediately infected with ſowerneſs by contagion of the *Caske*. The experience conſiſts in that which was lately publiſht by an Engliſh Doctor, who transfuſing the blood of a Mangie Dog into a ſound one, to try whether the Mange would be communicated with the blood, found the Mangie Dog cur'd, and the other who had receiv'd his blood not to become Mangie.

Now

Now to anſwer to all this in order, I ſay in the firſt place, that ſuch a great intemperature, from whence 'tis ſaid the blood can never recover, is either rare or very common. If very rare, it requires not much conſideration, and if the mixture of laudable blood ſuffice not to reſtore it to its due temperament, I would gladly learn other meanes to do it. But if ſuch intemperature be ordinary in all diſeaſes and in all declining old Ages, I demand to what end ſerve the aliments which *Phyſick* allows, or the *Medicaments* it preſcribes in theſe occaſions? Can theſe things enter into the body without mingling with the blood within an houre? And if by ſo mingling they contract the ill temperament of the blood, and impart not to the ſame any of their good qualities, is it not loſſe of time to ſtudy Phyſick, and to reduce into practice what we are taught touching the choice of all thoſe things? For my part, I am ſo far from having ſuch a thought, that I doubt not but the ſtrength & goodneſs of the meats & drinks we take, is able to correct the ill temperament of the blood and render it better: If there be any impediment of this effect, I ſhould not ſo much look for it in the blood it ſelf, or in the parts which elaborate the ſame, as in thoſe through which the aliments paſſe before they arrive at the heart. For 'tis ſufficiently manifeſt that if there be any irregularity in the ſtomack, if the digeſtion be not well made, if the juyces of the Gall and Pancreas (which ſerve for Diſſolvents in the Inteſtines) be not well temper'd, if there be any Obſtruction or Abſceſſe in the Glandules of the Meſentery which ſtrain the purer portion of the Chyle; the beſt and moſt excellent things become ſo transform'd before their mixture with the blood, that no good nouriſhment or refreſhment to the ſick can with reaſon be expected from them.

Now in this way of *Tranſfuſion* all thoſe inconveniences are avoided; the blood communicated is not made to paſſe through thoſe many turnings and windings, where the leaſt corruption of a part deſtroys in an inſtant whatever good the ſoundneſs of the reſt can produce. The good blood enters im-

immediately into the Veins of the receiving Animal, and there mixing and circulating with the reſt, carries good nouriſhment to the principal parts, which are not ordinarily indiſpoſed in ſickneſs and old age, but by the vitioſity and faultineſs of the blood which humecteth them.

This is an Opinion which I ſee many Phyſitians embrace, and were any thing capable to make me renounce it, the *Barrel* of *Vinegar*, above mention'd muſt not be it. For if *ſowerneſs* be the laſt quality which Wine aſſumes, and (as I may ſay) its Death, ſince it is never recoverable from the ſame; I do not believe that a like quality is to be found in the blood; that is to ſay, which corrupts the blood in ſuch manner that it can never be purifi'd, unleſſe perhaps in ſome Diſeaſes accounted incurable, which are not pertinent to the Queſtion. But if compariſons be currant, let us rather conſider Wine with all ſorts of other qualities but ſowerneſs, and then our compariſons will in my opinion, fall more juſt. For as the rougheſt Wine may be ſweetned, the fowleſt clarified, the weakeſt become ſtronger, the Oylie rid it ſelf of its fatneſs; in a word, that which is decay'd may be amended by mixture of certain liquors, known to thoſe that have the ſecrets of them, and practiſe the ſame every day: In like manner, 'tis reaſonable to conceive that blood too thick may be refined and ſubtiliſed, that too ſubtle be fixed and incraſſated, that too hot be temper'd, that too cold be heated; and all this by the mixture of other ſorts of blood, the particular qualities whereof are known to the Phyſitian who preſcribes the *Tranſfuſion*.

As for the Experiment of the *Dog*, which is ſaid to have received the corrupted blood of another Mangie one without contracting his diſeaſe; many things of ſufficient importance may be ſaid to it. 1. Is there any aſſurance that the blood of the Mangie Dog was putrefied, and corrupted in his Veins? On the contrary might it not have been purified before, by diſcharging its impurities through the pores of the fleſh, where the ſame was converted into Mange upon the Skin. That which confirms me the more in this particular, is, that very

very frequently Scabs divert a greater malady; ſince if thoſe impurities which cauſe the ſame, iſſued not out at the ſurface of the body, they would remain mixt with the ſubſtance of the blood, and falling upon ſome noble Part, produce very dangerous effects therein. 2. Suppoſing the blood of the Mangie Dog wholly corrupted in his Veins, is it neceſſary it ſhould produce the Mange in him that receives it? Is it not poſſible that vitious blood may be purified when it becomes mixt with better, and that the great heat which cauſed the extravaſation in the one in order to production of the Mange, may be allayed by the coolneſs of the other wherewith it is mixt, and conſequently not produce the ſame effects. Laſtly, Is there any aſſurance that the Mangy Dogs blood hath not produc'd ſome evil effects in the body of him who receiv'd it? He ſhould have been open'd ſome days after, and perhaps the corruption which render'd not it ſelf apparent outwards, might have been viſible within.

Hitherto therefore I find not either Reaſons or Experiments ſufficient from the opinion I have conceived of the benefit of *Tranſfuſion*; and in the Diſcord I obſerve of Phyſitians, whereof ſome approve the Invention, and maintain that it may with prudence be preſcrib'd for the care of divers Diſeaſes, others reſpect it as a very uſeleſs Novelty; and Laſtly, others keep themſelves undetermin'd, expecting what ſucceſſe the Experiment will produce; I willingly joyn with the firſt, and reſign my ſelf to the enſuing reaſons, until ſome body ſhall produce others to the contrary of greater weight.

1. The *Tranſfuſion* of the blood of one Animal into another is ſufficiently taught us by Nature it ſelf, and it muſt be granted that if we ever practiſe the ſame, we ſhall do no more but imitate her; ſince whil'ſt ſhe cannot yet adminiſter nouriſhment to the *Fœtus* by the mouth, and his ſtomack is not fit for digeſtion, ſhe makes a continual Tranſfuſion of the Maternal blood into the Umbilical Vein of the Infant, therewith to nouriſh, vivifie and encreaſe all the parts of the ſame. Nor is it to be anſwered here, that the Mother and Child are in this ſtate to be conſider'd, but as one and the ſame Body and Subſtance. For it happens frequently enough, that the Paternal

Seed predominating above that of the Mother, the Conſtitution of the Fœtus is very different from her's that bears it, although nouriſht by the transfuſion of her blood.

2. The *Transfuſion* of blood is but a very compendious way of the continual transfuſion of our Aliments, which is alſo taught us by Nature after our birth. For, whereas the Meats which we eat for the reparation of our ſtrength, and refreſhment of the heated parts, have very many impurities mixt with their good juices, which muſt be concocted by the heat, and digeſted in the acid Liquor of the Stomach; which done, the purer portion of the ſame digeſted juices is converted into Chyle, that Chyle impell'd into the Veins to be mingled with the Blood, convey'd therewith to the heart, and there receive its utmoſt perfection; The *Transfuſion* of blood is made more ſpeedily, and with much more effect, ſince thereby, in a very ſmall time, a moſt elaborated Liquor is immitted immediately into the Veins, where it inſtantly redreſſeth ſuch defects as it findeth in the internal parts, when they are diſtemper'd.

3. Phyſitians cannot deny, That the greateſt part of our Diſeaſes are but Reſults of the Diſtemper and Corruption of the blood, ſince the ſpeedieſt and commoneſt remedy they have in Practice, is, to evacuate the ſame by Phlebotomy, or elſe refreſh and cool it by Juleps. But they muſt alſo confeſs, That whilſt they endeavour to draw out the Corruption, they at the ſame time diminiſh the ſtrength and vigor; and that great Fevers by this means are oftentimes follow'd by Faintneſſes and Dropſies: On which conſideration, ſome Phyſitions ſpare bleeding as much as poſſibly they can. Moreover, it muſt be acknowledged, That Drinks paſſing through the Stomach and Inteſtines, before it arrive at the Veins and Arteries, to be mingled there with the blood, they may be alter'd a thouſand waies by the Ferments occurring in the paſſage, or elſe they may cauſe ſome alteration in thoſe parts by Ferments accompanying them, and ſo leave weakneſſes and dangerous Crudities behind them. But in *Transfuſion* all theſe things are avoided, and all Phyſitians brought to agreement within a ſhort time. They who are for blood-letting, find

find the ſame practis'd in this Operation, the old and corrupt being firſt evacuated, to make room for new and pure. And thoſe alſo that decry bleeding, as that which too much weakens the ſick, will have no reaſon to complain, ſince the new blood conduceth to ſtrengthen them more.

Laſtly, Every one knows that many perſons dye through loſs of blood, and Hæmorrhagies not to be ſtopt, many are emacerated by them, and others precipitated into untimely old Age, by defect of blood and vital heat. Now who doubts but the *Transfuſion* of a mild and laudable blood may preſerve the one, and prolong the life of the others. A man may foreſee ſome benefits and advantages from this Operation in *Pleuriſies, the ſmall Pox, Leproſies, Cancers, Ulcers, St. Anthonies fire, Madneſs, Dotage*, and other *Maladies* ariſing from the Malignity of the blood: But the ſucceſs is rather to be expected in Experiments, which will be made within a little time. In the interim, give me leave to acquaint you with my Judgment concerning the Election of the Animal that is to communicate its blood.

Many have conceiv'd, That if ever the *Transfuſion* of blood ſhould come to be practis'd upon men, it ought to be done with blood of the ſame Species; and conſequently, That it would be a very barbarous Operation, to prolong the life of ſome, by abridging that of others. But for my part, I am far from that Opinion, and I am perſwaded that it will be much more expedient to make uſe of the blood of other Animals, than of that of men, for many reaſons, the chief whereof are theſe.

1. 'Tis eaſie enough to judge, That the blood of Animals is leſs full of impurities, than that of men; becauſe debauchedneſs and irregularity in eating and drinking, are ſo ordinary to them, as to us. Sadneſs, Envy, Anger, Melancholy, Diſquiet, and generally all the Paſſions, are as ſo many cauſes which trouble the life of man, and corrupt the whole ſubſtance of the blood: Whereas the life of Brutes is much more regular, and leſs ſubject to all thoſe miſeries, which we ought to conſider as ſad conſequences of the prevarication of our firſt Parents. And indeed Experience ſufficiently ſhews us,

That if 'tis a rare chance to find its blood in the Veins of Beasts; 'tis almost impossible not to find some corruption in that of Men, how healthful soever they seem to be. Yea, even in Children yet sucking, it is not wholly unblamable; because, having been nourisht with the blood and milk of their Mothers, they have suckt corruption together with their nourishment.

2. If Physicians so successfully employ the milk of certain Animals, to which they oblige certain Patients for some whole years together: If we are very well nourisht with the flesh of some, during all our lives; and if their juices be so advantageous to us for repairing our natural strength; Why may we not hope greater advantages from the mixture of their blood with ours.

3. The Operation may be made more boldly, and with greater succes by employing Brutes. For, being we design to take the best blood that is to be had, and least subject to coagulation, 'tis certain that the Arterial blood upon acount of its heat and tenuity, possesseth both those qualities in much more perfection than the Venal. And the dangers and inconveniencies which would occur in opening the Arteries of a man are not considerable, when 'tis a beast on whom the Operation is made.

4. Beasts may be better fitted and prepar'd for this use than men. For I should advise those, that would employ this Experiment to the best advantage, to feed their Beasts for some daies before-hand with more care and exquisiteness than ordinary: since, if by the taste we can discern the flesh of Calves fed for some time, with Milk, and Yolks of Eggs to be much more pleasant than that of others; reason ought to perswade us that their blood is also meliorated according to their feeding.

All these Reasons joyn'd to the Experiments we have made, could not but induce us to give assurance to the publick of the little danger to be fear'd, and the considerable effects to be expected from this Operation. Yea, we imagin'd 'twere no rashness to make tryal of it upon men, and indeed divers persons of much gravity and prudence sollicited us to beg some condemned Criminal, on whom to make the first Essay. But having

ving conſider'd that a man in that condition, being already much diſorder'd by the apprehenſion of death, might be further intimidated, by looking upon this transfuſion as a new kind of death; and thus, conceit might poſſibly caſt him into faintings and other accidents, which would undoubtedly be aſcribed to the Experiment by ſuch as decry it: We thought not fit to expoſe our ſelves to that danger, nor to importune his Majeſty without any neceſſity; being perſwaded that there would not be ſo much reaſon to fear the like events in perſons whom we knew perfectly well, and who had ſome confidence in our words, we choſe rather to wait till a favourable occaſion offer'd us ſuch a perſon as we wiſht, than to hazard the loſs of all by too much precipitation. This Reſolution being taken we neglected nothing that prudence obliged us unto; and at length after ſome attendance we lighted upon a ſubject ſutable to our wiſhes. The particularities of our proceedings I here ſubjoyn in few words, they being as ſo many authentick confirmations of all that I have hitherto written.

On the 15 of this Moneth, we hapned upon a Youth aged between 15 and 16 years, who had for above two moneths bin tormented with a contumacious and violent fever, which obliged his Phyſitians to bleed him 20 *times*, in order to aſſwage the exceſſive heat.

Before this diſeaſe, he was not obſerved to be of a lumpiſh dull ſpirit, his memory was happy enough, and he ſeem'd chearful and nimble enough in body; but ſince the violence of this fever, his wit ſeem'd wholly ſunk, his memory perfectly loſt, and his body ſo heavy and drowſie that he was not fit for any thing. I beheld him fall aſleep as he ſate at dinner, as he was eating his Breakfaſt, and in all occurrences where men ſeem moſt unlikely to ſleep. If he went to bed at nine of the clock in the Evening, he needed to be wakened ſeveral times before he could be got to riſe by nine the next morning, and he paſs'd the reſt of the day in an incredible ſtupidity.

I attributed all theſe changes to the great evacuations of blood, the Phyſitians had been oblig'd to make for ſaving his life, and I perſwaded my ſelf that the little they had left him

was

was extreamly incruſtated by the ardour of the fever (which uſually diſſipates only the more tenuious part) and ſo ſtagnating in his veſſels, he wanted the motion and heat neceſſary to volatiliſe the ſame, and to diffuſe a ſufficient activity into the Nerves and Muſcles. Accordingly my conjecture was confirmed by our opening one of his Veins, for we beheld a blood ſo black and thick iſſue forth, that it could hardly form it ſelf into a thread to fall into the porringer. We took about three ounces at five of the Clock in the morning, and at the ſame time we brought a *Lamb*, whoſe *Carotis Artery* we had prepar'd, out of which we immitted into the young mans Vein, about three times as much of its Arterial blood as he had emitted into the Diſh, and then having ſtopt the orifice of the Vein with a little bolſter, as is uſual in other phlebotomies, we caus'd him to lie down on his Bed, expecting the event; and as I askt him now and then, how he found himſelf, he told me that during the operation he had felt a very great heat along his Arm, and ſince perceiv'd himſelf much eaſed of a pain in his ſide, which he had gotten the evening before by falling down a pair of ſtaires of ten ſteps, about ten of the clock he was minded to riſe, and being I obſerved him cheerful enough, I did not oppoſe it; and for the reſt of the day, he ſpent it with much more livelineſs than ordinary; eat his Meals very well, and ſhewed a clear and ſmiling countenance. He bled only 3 or 4 drops at the noſe, about 4 a clock of the evening, and after he had ſupt very well, I cauſed him to go to bed about 9, and falling aſleep at 10, he awakned at 2 after mid-night, and finding that he could not fall aſleep again, he aroſe at 4 in the morning. All this day we obſerv'd his humor much more lively, and the agility of his body much greater than ordinary. The next day he ſlept a little more, and from that time he eaſily got the victory over his drowſineſs, which before he had often attempted without ſucceſſe; for now he never fails to riſe very early without needing to be wakened. He executes nimbly whatever is appointed him, and he hath no longer that flowneſs of ſpirit nor heavineſs of body, which before render'd him unfit for any thing. He grows fat viſibly, and in brief, is a ſubject of amazement to all thoſe that know him, and dwell with him.

Now

Now who ſees not that all theſe admirable effects undoubtedly proceed from that little Arterial blood of the *Lamb*, which having been mixt with the maſs of his thick blood, was like a ferment to it, to rarifie and attenuate it more than ordinary, whence follow'd the production of greater plenty of ſpirits, and a more nimble performance of the actions of the body.

This firſt Tryal thus ſucceeding engag'd us to make a ſecond upon a ſtronger *Man*, aged *45 years*. Now this Man having no conſiderable indiſpoſition, we intended to make a larger Transfuſion upon him, than on the former. But finding his veſſels very low & not well fill'd with blood, we took from him only about 10 ounces, and afterwards immitted into him twice as much from the *Crural Artery* of a *Lamb* purpoſely provided for it, as well becauſe the ſame is bigger and eaſier to come at than the *Carotis*, as for that we would put ſome difference between this ſecond Experiment, and the firſt. The man abated nothing of his Jovial humor during all the time of the Operation, and amongſt other reflections which he made concerning the placing of the *Lamb* near his *Arme*, he ſaid merrily that there were ſtrange waies in Phyſick to preſerve life, that he knew not who had invented this of bleeding, but that he felt a very great heat from the Orifice of his Vein up to his arm-pit; which proceeded from the courſe of the new *Arterial* blood, paſſing up that way towards the heart.

When the Operation was ended, we adviſed him to lie down to reſt; but being he found no indiſpoſition in himſelf, 'twas impoſſible to prevail with him, and we could not keep him from falling to work with the poor *Lamb*, cutting his throat, and fleaing him, in which he is very dextrous, having exercis'd the ſame profeſsion from his youth. Afterwards he declared his intention to return home, and promiſed us that he would take a meſs of ſome comforting broth there, and lay himſelf to reſt for the remainder of the day; but aſſoon as he went forth; he betook himſelf to find out his Comerades, and carryed them to the Tavern to drink part of the money given him for his daies buſineſs: at noon finding himſelf more hearty, (whether by the new blood he had received ſix hours before, or by the quantity of wine he had drank) he fell upon a ſort of

work

work ſo laborious to his whole body that it might almoſt tire a horſe; thus he ſpent all the afternoon, and ſo kept us from making ſuch obſervations upon him as we had intended. I met him the next day in the ſtreets, and underſtanding from himſelf this behaviour, I was ſurpriſed at it, and blam'd him of imprudence. But he told me in excuſe of himſelf, that he could not be at reſt when he was in health, that he had felt no pain either during or after the operation, that he had eaten, drank and ſlept very well, that he had more ſtrength than before, that if we were minded to repeat the ſame experiment at any time, he deſired we would chooſe no other perſon for it but him, & that another time he would lie down to reſt, and punctually behave himſelf as we ſhould command him.

This is an account of our Experiments, which indeed have not yet proceeded very far; nevertheleſs I could not longer conceale them from your curioſity, knowing well that from theſe few obſervations you will forſee conſequences and advantages enough. I have not deſcribed the manner of our making this Experiment upon man, which is very different from that which we uſe upon beaſts: but the particular relation would be but tedious and uſeleſs to you, ſince you will behold it more plainly in an example when ever you ſhall find a convenience to command us to make the ſame before you. And I aſſure my ſelf, you will therein admire the dexterity and ſagacity of Mr. *Emmerez*, and confeſs that his induſtry renders him as happy in this operation as in many others of Chirurgery which are much more difficult; for indeed 'tis done with as much ſpeed as an ordinary phlebotomy, and he that receives new blood complains not of any pain that he feels.

But I perceive that I abuſe your patience, and that the length of my letter hath paſſed the bounds wherein the reſpect I have for the perſon ought to confine me, I beſeech you pardon me this liberty, and be not diſpleas'd that I take this occaſion to conſecrate to you my moſt humble ſervice, and to aſſure you that I am,

Sir, Your moſt humble and obedient ſervant,

Paris, June 25. 1667.

J. DENIS.

PHILOSOPHICAL TRANSACTIONS.

For the Months of *July*, *Auguſt*, and *September*.
Munday, *Septem.* 1667.

The Contents.

An Advertiſement concerning the Invention of the Transfuſion of Bloud. *An Account of ſome Experiments of* Infuſing *Liquors into the Veins of Animals*; *As alſo of ſome new diſcoveries pretended to be made in tke* Brain *and the* Tongue. *An Experiment upon* Bloud *grown cold. Some Obſervations of* Quickſilver *found at the roots of Plants*; *and of* Shells *found upon* in-land *mountains*; *Other Obſervations made by a curious perſon in his Voyage from* England *to the* Caribes, *concerning the* Ruſting of Iron *by the Sea-air*; *the* Changes of Thames-water *carried by ſea*; *The* Variety of the Colours of the Sea; *The* Burning *of the ſame*; *the* Night-winds *in the* Indies; *The Relations of the* Seaſons of the year *rectified*; *Obſervables about* Tortoiſes; *The condition of* Engliſh *bodies firſt coming to* Jamaica; *A way of preſerving* Ale *as far as to the ſame Iſland. An Extract of a Letter concerning ſome* Magnetical *Experiments*; *and an Excellent Liquor made of Cyder-Apples and Mulberries. An Account of two or three Books*; *One*, The HISTORY of the ROYAL SOCIETY: *The other*, DISQUISITIO DE FÆTU FORMATO, *The third*, MUSCULI DESCRIPTIO GEOMETRICA.

An Advertiſement concerning the Invention of the Transfuſion of Bloud.

THE Author of theſe Papers returning now to his former Exerciſes, which by an extraordinary Accident he was neceſſitated to interrupt for ſome months laſt paſt, thought fit to compriſe the *Tranſactions* of all the Months omitted in one *Tract*: In the very beginning of which he muſt inform the *Reader*, that if himſelf had publiſhed that *Letter*, which came abroad in *July* laſt, *Concerning a new way of curing ſundry diſeaſes by Tranſfuſion of Bloud*, written to *Monſieur de Montmor*, &c. by *J. Denis Prof. of Philoſophy*, &c. he ſhould then have taken notice, as he doth now, of what

is affirmed in that *Letter* about the *time* and *place* of the *Conception* of that Transfuſing deſign; and intimated to the Curious, that how long ſoever that Experiment may have been *conceived* in other parts (which is needleſs to conteſt) it is notorious, that it had its *birth* firſt of all in *England*; ſome Ingenious perſons of the *Royal Society* having firſt ſtarted it there, ſeveral years ago, (as appears by their *Journal*) and that dextrous Anatomiſt, D. *Lower*, reduced it into practice, both by contriving a method for the Operation, and by ſucceſsfully executing the ſame: wherein he was ſoon overtaken by ſeveral happy Trials of the skilful hand of D. *Edmund King*, and others, encouraged thereunto by the ſaid Society; which being notified to the world *Numb.* 19. and 20. of theſe *Tranſactions*, Print-*Novem.* 19. and *Decemb.* 17. 1666; the Experiment was, ſoon after that time, heard of to have been tried in forein parts, without hearing any thing then of its having been *conceived ten years ago.*

An account of ſome Experiments of injecting Liquors *into the Veins of Animals, lately made in* Italy *by Signior* Fracaſſati *Profeſſor of Anatomy at* Piſa.

1. Having infuſed into the *Jugular* and *Crural* Vein of a Dog ſome *Aqua fortis* diluted, the Animal died preſently; and being opened, all the bloud in the Veſſels was fixed, but that in the guts not ſo well. It was alſo obſerved, that the great veſſels were burſt, perhaps by an effort of Nature: even as in the greateſt part of thoſe that die of an *Apoplexy*, the veſſels of the Lungs are found broken. Upon which Experiment the Author maketh theſe Reflections: *Firſt*, That an *Apoplexy* being often cauſed by a like Coagulation of the bloud (as hath been obſerved by the opening, made of ſundry perſons, who died of that diſtemper) it might be cured by a timely infuſing ſome *Diſſolvent* into the veins. *Secondly*, That it is likely, that that uſeful ſecret, by which Monſieur *de Bills* diſſected Animals without any effuſion of bloud, conſiſts in ſome ſuch Infuſion.

2. There was afterwards infuſed into another Dog ſome *Spirit of Vitriol*, which had not ſo preſent an effect; for the Animal complained a great while, and foam'd like *Epileptick*s, and had its reſpiration very thick; and obſerving the beating of his breaſt, one might eaſily judge, the Dog ſuffered much: who dying at laſt, his bloud was found fixed in the veins, and grumous, reſembling ſoot.

3. Then there was injected into a Dog ſome *Oyl of Sulphur*: But he died not of it, though this Infuſion was ſeveral times tried upon him. And

the

the wound being cloſed, and the Dog let go, he went into all the corners of the Room ſearching for meat, and having found ſome bones, he fell a gnawing of them with a ſtrange avidity, as if this Liquor had cauſed in him a great appetite.

4. Another Dog, into whoſe veins ſome *Oyl of Tartar* was injected, did not eſcape ſo well: For he complained much, and was altogether ſwoln, and then died. Being opened, the Spectators were ſurpriſed to find his bloud not curdled, but on the contrary more thin and florid than ordinary; which ſeems to hint, that a too great fluidity of the bloud, as well as its Coagulation, may cauſe death.

An Account of ſome Diſcoveries concerning the Brain, *and the* Tongue, *made by Signior* Malpighi, *Profeſſor of Phyſick in* Sicily.

1. He pretends to have diſcovered, that the Exterior and ſofter part of the *Brain*, doth not *cover* only the *Corpus calloſum*, as hath been believed hitherto, but is alſo *inſerted* into it in many places. He hath alſo obſerved, That the *Corpus calloſum* is nothing but a Contexture of ſmall *Fibres*, iſſuing from the *Medulla Spinalis*, and terminating in the ſaid Exterior part of the Brain. And theſe *Fibres*, he ſaith, are ſo manifeſt in the *Ventricles* of *Fiſhes* brains, that when they are looked through they repreſent the figure of an Ivory Comb.

2. The *Uſe*, which he aſcribes to the Brain, is much different, he ſaith, from what hath been aſſigned to it hitherto. He pretends, that as half, or at leaſt, a third of the bloud of an Animal is conveighed into the Brain, where yet it cannot be conſumed, the fineſt *Serum* of this bloud is filtrated through the exteriour part, and then entring into the *Fibres* of the brain, is thence conveighed into the *Nerves*: which he affirms to be the reaſon, that the Head is ſo often found full of water, when the Brain hath received a wound, or an alteration by ſome diſtemper.

3. He hath taken a particular care of examining the *Optique Nerve* in divers Animals, it being one of the moſt admirable productions in the Brain. Having therefore among other Fiſhes diſſected the head of a *Xiphias* or *Sword-fiſh*, who hath a very big eye, he hath not obſerved any conſiderable cavity in the *Optique Nerve*, nor any *Nervous Fibres*; but found, that the middle of this Nerve is nothing elſe, but a large Membrane folded according to its length in many doubles almoſt like a *Fan*, and inveſted by the *Dura Mater*. *Euſtachio* a famous Anatomiſt, had written ſomething of this before, but obſcurely, and without mentioning the Animal, wherein he had made this obſervation.

4. The ſame *Malpighi* thought he ſhould have met with the ſame thing in *Terreſtrial* Animals; but he found, that *Fiſhes* alone have ſuch a ſtructure of the *Optique Nerve*: For that of an Ox, Pig, and other ſuch Animals, is nothing but a heap of many ſmall *Fibres* of the ſame ſubſtance with the Brain, wrapped about with the *Dura Mater*, and accompanied with many little veſſels with bloud. Hence he draws the deciſion of that great queſtion among Anatomiſts; *Whether the* Optique Nerve *be hollow or not?* For, *ſaith he*, it cannot be otherwiſe, but there muſt be many cavities in this Nerve; foraſmuch as the ſmall filaments, of which it is compoſed, cannot be ſo cloſely joyned, that there ſhould not be ſome void ſpace betwixt them.

5. Concerning the *Tongue*, the ſame *Author* hath diſcovered in it many little *Eminences*, which he calls *Papillary*, and believes to be the principal Organ of *Taſte*. * But here is not to be omitted the Obſervation of *Fracaſſati*, importing, that as the *Tongue* hath towards its *point* many *Eminences*, by the means whereof it goes, as it were, to meet objects of *Taſte*; ſo on the contrary, it hath many *cavities* towards its *root*, wherein it receives them. All which cavities terminate in *nerves*, and ſeem to ſerve for *Funnels* to conveigh the aliment into them. Which maketh the Author think it very probable, that the fineſt part of the aliment paſſeth immediately from the *Tongue* into the *Nerves*, whence it comes to paſs, that Wine, being only taken into the mouth, reſtoreth vigour preſently.

* See *Numb.* 20. of the *Tranſactions*, pag. 366. where a large account is given of this diſcovery, from the Treatiſe of *Laur. Bellini, de Organo Guſtûs.*

An Experiment of Signior Fracaſſati *upon Bloud grown cold.*

When any bloud is become cold in a diſh, that part which is beneath the *ſuperficies* appears much blacker, than that on the top; and 'tis vulgarly ſaid, that this black part of the bloud is *Melancholy* bloud, and men are wont to make uſe of this example to ſhew that the *Melancholy* humor as 'tis called, enters with the 3 others into the compoſition of the bloud. But Signior *Fracaſſati* maintains, that this *blackiſh* colour comes from hence, that the bloud, which is underneath, is not expos'd to the Air, and not from a mixture of *Melancholy*: to prove which he aſſures, that upon its being expos'd to the Air it changes colour, and becomes of a florid red.

An Experiment as eaſie to try, as 'tis curious.

Some

Some Obſervations
Communicated by Signior Manfredus Septalius *from* Milan, *concerning* Quickſilver *found at the roots of Plants, and Shels found upon* In-land *Mountains.*

This *Italian* Virtuoſo, famous for his knowledge and curioſity, as well as for his Hoſpitality to ingenious ſtrangers, did in a late Letter of his to the Publiſher, impart the following Particulars.

1. In the Valley of *Lancy*, which runs between the Mountains of *Turin*, grows a Plant like the *Doronicum*, (ſo alſo called by the Inhabitants and Botaniſts;) near the roots whereof you may find pure Quickſilver, running in ſmall grains like Pearls; the juice of which Plant being expreſſed, and expoſed to the Air of a clear night, there will be found as much *Mercury*, as there is loſt of Juice. *

* This may be compared with thoſe Relations, which acquaint us, that in *Moravia*, *Hungary*, *Peru*, and other parts; Mineral Juices concreted are found to ſtick to the roots of Herbs and Trees, ſome of thoſe Juices tinging alſo the Leaves of Vegetables.

2. In a Voyage he made a few years ſince to *Genoa*, when he was to paſs ſome mountains, he met with ſome Peaſants, who digging on the ſides of an Hill, had found and gathered very many *Cockle-ſhels* of divers kinds; which he wondring at, ſtopped his intended Journey, and went to the very place, where he was ſatisfied of the truth of the relation, finding great ſtore of different ſhells, as the *Turbinets*, *Echini*, and ſome Pearl-ſhells, whereof one had a fair Pearl in it, which, he ſaith, he put into his *Repoſitory*.

Obſervations *Made by a Curious and Learned Perſon, ſailing from* England, *to the* Caribe-Iſlands.

Theſe Obſervations ſhall be ſet down in the Authors *own words, as they were obtained from him by Sir* R. Moray; *viz.*

I Took notice at *Deal*, whence I ſet ſail for *Jamaica*, of the great difference in the *ruſting* of *Iron*, in ſuch houſes, as front the Sea, in compariſon of that effect in the Street immediately placed behind

that other, in which I made this obſervation. They told me that it ruſted more at High-floods, than at Neap-tides; the height of the *Beach* hindring the *Saline* exhalations. This remark put me in mind of the vanity of the Argument of M. *Ligons* and others, *viz.* That the Air of the *Weſt-Indies* was hot and moiſt, becauſe of the *Ruſting of Iron*; whereas it indeed ariſes from ſome other principle in the Air; for at the point of *Cagua*, where it ſcarce raineth 40 ſhowers in a year, Iron ruſts as much or more than any where; yet are there other parts of the *Iſland*, in which of 9 months not one paſſes without great Rains: beſides, in *Jamaica* it ruſts leaſt in rainy Weather.

The Steams of the Sea are found of ſuch a nature, that our ſweetmeats rotted; Sugar of Roſes, and other Lozenges grew moiſt; notwithſtanding that there was no reaſon to attribute it to any rainy weather. And thoſe Pies and Gammons of Bacon, which had kept well before, after they had been once expoſed to the open Air, decayed more in a day or two, than in ſix weeks before.

On the point *Cagua*, the Iron-Guns at the Fort were ſo corroded, that ſome were near become uſeleſs, being perforated almoſt like Hony-Combs: And I could at any time with 2 or 3 ſtroaks of a Hammer break off ſome pounds of Ruſty Iron, which ſerved for prepared *Steel*, and in *Salves*. But the Guns which lay in the Salt-water, were not much endamaged by Ruſt; as we found, upon taking up of ſome.

Many things receive damage by the Air: Not only *Iron* ruſts, but even *Linnen* rots, and *Silks* once expoſed to the Air do rot without loſing their colour. If a *Lancet* be once expoſed to the air it will ruſt, though you preſently put it up again; but if it be never expoſed to the Air, it will hardly ruſt.

At *Deal* a certain Ale-ſeller will warrant, that the Ale, as he orders it, ſhall be carried good to the *Weſt* or *Eaſt-Indies*. His way to prepare it is this, as he told me himſelf, he twice maſhes it with *Freſh-Malt*, and twice boils it well; yet all this kept it not from ſowring; as I obſerv'd during my ſtay there. We bought of it to carry to *Jamaica*, and then he directed us thus. To every Rundlet of 5 *Gallons*, after it is placed in the ſhip, not to be ſtirred any more, put in two new-laid Eggs whole, and let them lie in it; he ſaid that in a fortnight or little more, the whole Egg-ſhells would be diſſolved, and the Eggs become like Wind-Eggs, incloſed only in a thin

skin

skin; after this, the whole *White* would be prey'd on, but the *Yolk* would not be touch'd or corrupted. By this means we did preſerve the Ale to *Jamaica*, and it was much better, than at *Deal*. I was told ſince by ſome others that the Experiment is uſual with them, to keep Ale in *England* a quarter of a year: And if Eggs be thus put into *March-beer*, they preſerve it from growing ever harſh. They muſt be put in, after the Liquor has done working.

Concerning the *Thames-water*, it is not only obſervable, that in eight months time it acquires a Spirituous quality, ſo as to burn like Spirit of Wine; and ſome *Eaſt-India* ſhips, I am informed, have run the hazard of firing by holding a Candle near the Bung-hole at the firſt opening of the Cask;) but alſo that the ſtinking of it is no corruption, nor perhaps unwholeſome; for we drank it all the way, ſo as to hold our Noſes, yet had no ſickneſs, but we had proportion of *Brandy* each week, which perhaps might correct it. If you take off the Bung from any Cask that ſtinks, and let the Air come to it, it will in 24 hours become ſweet again. And if you take a Broom-ſtick, and ſtir it about well, it will become ſweet in 4 or 5 hours caſting a black Lee to the bottom, which remixes with it, and ſo occaſions a third or fourth fermentation, and ſtench; after which it ſtinks no more. But, though *Thames-water* upon ſtench do not putrifie, yet other Waters (as far as hath been hitherto obſerved) do become irrecoverable upon ſtinking, and dangerous to drink.

I obſerv'd at Sea, that though *Glauber* ſay, the water, as it grows *Salter*, becomes *Greener*, yet that is falſe. For, after we were out of the Narrow, the Sea grew *darkiſh*, and after perfect *Azure*, yet was it much more Salt, the farther we went: as I tried by a *Water-poiſe* of Glaſs, with Quick-ſilver at the one end, it roſe about half an inch above the Sea-water in the *Downs*; and at 24 *degrees* more, 2 *inches*. But after that, I never obſerved any difference unto *Jamaica*, the Sea being probably ſo impregnated with Salt, as not to imbibe more; which croſſes another obſervation, that the nearer the *Tropiques* and the *Line*, the Salter the Sea.

As to the *Colour* of the Sea, I conceive there is as great variety in it and its ſteams, as in Grounds at Land; which may occaſion the ſickneſs in ſome places more than in others: For the Sea ſmells differently in the *Narrow* and *Main*. And as to colour, it is of a Sea-green (and more ſickly) in the *Downs*, than at *Torbay*, and on *Plymouth* coaſt more, than paſt the *Lands-end*; and in the *Bay* of *Biſcay*, than

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in the *Long-reach*. Something perhaps may be imputed to the difference of the waves, which are ſhort, and make a Copling Sea in the *Bay* of *Biſcay* (yet we came not within 80 Leagues of *Cape Finis Terræ*:) in the *Long-reach* it is a long rolling wave, but never breaks. About *Florida*, *Virginia*, and *New-England* it is a great rolling wave, but breaks. And as the Sea coloureth from *green* to *darkiſh*, and ſo to *blue*; ſo in our return it colour'd from *blue* to *dark*, and ſo to *green*. When we were in the *Latitude* of *Barbadoes*, and had ſailed ſo for two daies, and apprehended our ſelves to be within 70 or 80 Leagues, I obſerved the Sea was black and thick, not tranſparently blue, as before, and the foam againſt the Ship-ſides was turbid, and of another conſiſtence, than before. I had never ſeen the like before, yet was I willing to think the Sun not high enough, to give the water its due colour. I attended the Suns progreſs, but behold, it turn'd *Green*; whereupon I asked the Maſter, who told me, we were within 60 leagues of *Barbadoes*, and that the Sea was there ſoundable, whereas before it was not ſo. But at *Barbadoes* in the anchoring places, it was *Blue*; and as we row'd aſhore, in the ſhallow it was *Whitiſh*: And ſo at *Jamaica* near the ſhore it is tranſparently *White*, but within three yards more, tranſparently *Blue*.

As to the *Burning of the Sea*, I could never obſerve ſo great a Light, as to perceive Fiſhes in the Sea of the Stern, though I frequently looked, as well as M. *Ligon*; yet was the light great, and at ſometimes more than other. I ſuppoſe ſeveral ſubject Earths, Currents, and Winds do vary it. I obſerv'd, it burned more at *Deal* the night before we ſet ſail, than ever in the Voyage: all the water ran off our Oars, almoſt like liquid fire; the wind was then *South-Eaſt*, and the Sea-men told me, that at *Eaſt* and *South*-winds it burned moſt. And it did never burn ſo much during our ſtay at *Deal*, as then, the wind having been alwaies *Weſterly*. But in the *Harbour* of *Jamaica* I obſerv'd, that it did not burn equally there. As you paſs the *Current* (which thwarts the middle of the *Harbour* with a motion, different from the water on both ſides) the water ſcarce ſeems *white* at the ſtroak of an *Oar*.

I ſhall not trouble you with an account, how two contrary Winds poiſe each other, and make a Calm in the midſt, ſhips at a diſtance ſailing with contrary gales at the ſame time.

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It is obſervable, that in the *Indies* ſuch places, as have any high mountains, have alſo every night a VVind, that blows from the Land, *Maugre* the *Levantine* VVind, which blows at Sea (but with a ſlacker gale all night; which ſeems to ſhew, it depends not only on the motion of the Earth, but Sun.) VVhence this VVind ſhould come, may be conſidered; there is none at *Barbadoes* or *Saona*, but at all the other Iſlands. And in *Jamaica* every night it blows off the Iſland every way at once, ſo that no ſhip can any where come in by night, nor go out but early in the morning, before the *Sea-briſe* come in. I have often thought on it, and could imagine no other reaſon, but that thoſe Exhalations, which the Sun hath raiſed in the day, make haſte (after his ſtrength no longer ſupports them) to thoſe Mountains by a motion of *Similar Attraction*, * and there gather in Clouds, and break thence by their own force and weight, and occaſion a wind every way. For, as the Sun declines, the Clouds gather, and ſhape according to the Mountains, ſo that old Seamen will tell you each Iſland in the afternoon towards Evening by the ſhape of the Cloud over it. And this *Attraction* appears further, not only from the Rain that gathers on the Tree in the Iſland of *Ferro*, ſpoken of by *J. Hawkins* in his Obſervations, and *Iſ. Voſſius* upon *Pomponius Mela*, as alſo *Magnenus de Manna*; but alſo from the Rains in the *Indies*, there being certain Trees which attract the Rain, though Obſervations have not been made of the *kinds*; ſo as that if you deſtroy the woods, you abate or deſtroy the *Rains*. So *Barbadoes* hath not now half the Rains, it had, when more wooded. In *Jamaica* likewiſe at *Guanaboa* they have diminiſht the Rains, as they extended their Plantations

* Poſſibly it may be more plain, to ſay, That thoſe Exhalations, condenſed by the Cool of the night, and impelled down-wards, fall by their weight, and then firſt of all meeting with the higher parts of the Earth, muſt needs gather and ſettle about the ſame, in clouds.

tions. But (to return to *Jamaica*) that this night-wind depends much upon the Mountain, appears by this, that its force extends to an equal diſtance from the Mountain, ſo that at *Port-morant*, which is the Eaſter-moſt part of the Iſland, there is little of Land-briſe, becauſe the Mountain is remote from thence, and ſpends its force along the Land thither. I ſhall further illuſtrate this kind of Attraction. In the harbour of *Jamaica* there grow many Rocks, ſhap'd like Bucks-- and Staggs-horns: there grow alſo ſeveral Sea-plants, whoſe roots are ſtony. Of theſe ſtone-trees (if I may term them ſo) ſome are inſipid, but others perfectly Nitrous. Upon thoſe other Plants with petrified roots there gathers a Lime-ſtone, which fixes not upon *other* Sea-fans, growing by them. It is obſervable alſo, that a *Monchinel-apple*, falling into the Sea, and lying in the water, will contract a *Lanugo* of Salt-peter: which is confirmed by the Author of the Hiſtory of the *Antiles*. To conclude this particular, the Captain of our Ship ventured to give me a reaſon for theſe winds, which I will not conceal from you, ſince it may put you upon an Experiment, which he ſaid he had often made: *Viz.* That the Sun did heat the Air, and exhale the Vapours, which after did ſettle on thoſe hills, and as they grew cold, took up more room than before, and ſo made a wind by their preſſure; as water, put hot into a Cask and cloſed, would, *he ſaid*, as it cooled, break the Cask.

It is commonly affirmed, That the Seaſons of the Year betwixt the *Tropicks* are divided by the Rains and Fair weather, and ſix Months are attributed to each Seaſon. But this obſervation holds not *generally* true: For at the *Point* in *Jamaica* ſcarce fall (as was, on another occaſion, hinted above) forty ſhowers in a year, beginning in *Auguſt* to *October* incluſively. From the *Point* you may look towards *Port-morant*, and ſo along to *Ligonee*, ſix miles from the *Point*, and you'l ſcarce ſee, for eight or nine months, beginning from *April*, an afternoon, in which it rains not. At the *Spaniſh* Town it rains but three Months in the Year, and then not much. And at the ſame time, it rains at *Mevis*, it rains not at the *Barbadoes*. And at *Cignateo* (otherwiſe called *Eleutheria*) in the Gulph of *Bahama* it rains not ſometimes in two or three years, ſo that that

Iſland hath been twice deſerted for want of rain to plant in.

At the *Point* of *Jamaica*, where ever you dig five or ſix foot, water will appear, which ebbs and flows, as the Tyde. It is not ſalt, but brackiſh; unwholſome for men, but wholſome for Hogs. At the *Caymans* there is no water, but what is brackiſh alſo; yet is that wholſome for men, inſomuch that many are recovered there, by feeding on Tortoiſes, and yet drink no other water.

The *Bloud of Tortoiſes* is colder, than any water, I ever felt there; yet is the beating of their Heart as vigorous, as that of any Animal (as far as I have obſerved.) And their Arteries are as firm as any Creatures I know: Which ſeems to ſhew, It is not heat that hardens the coats of the Arteries, or gives motion to the Heart. Their Lungs lye in their belly below the Diaphragme, extending to the end of their Shell. Their Spleen is Triangular, and of a firm fleſh (no Parenchyma) and floridly red. Their Liver is of a dark green, inclining to black, and Parenchymatous. In the *Oeſophagus* are a ſort of Teeth, with which they chew the graſs, they eat in the Meadows, which there grow at the bottom of the Sea.

All the *Tortoiſes*, from the *Caribes* to the *Bay of Mexico* and *Honduras*, repair in Summer to the *Cayman-Iſlands*, to lay their Eggs and to hatch there. They coot for fourteen daies together, then lay in one night ſome three hundred Eggs, with white and yolk, but no ſhells: then they coot again, and lay in the ſand, and ſo thrice. Then the Male is reduced to a kind of gelly within, and blind, and is ſo carried home by the Female. Their fat is green, but not offenſive to the ſtomack, though you eat it as broath, ſtew'd. Your Urine looks of a yellowiſh green, and oily, after eating it.

There is no manner of Earth, but Sand, at the *Point*; yet I have eaten admirable *Melons*, Musk- and Water-melons, that have grown there. A great many trees alſo grow there, eſpecially *Mangranes*, and *Prickle-pears*. In other parts it is ordinary to ride through woods, that are full of very large Timber, and yet have nothing of earth, only firm Rock, to grow in.

In ſome ground, that is full of Salt-peter, your *Tobacco*, that grows wild, flaſheth as it is ſmoaked.

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The fruit of Trees there of the ſame kind ripen not at one time: There is a Hedge of Plum-trees of two miles long, as you go to the *Spaniſh-Town*; on it I have many times remarked ſome Trees in *Flower*, others with *Ripe*, others with *Green* fruit, and others to have done bearing, at the ſame time. The like I have obſerved in other Trees. *Jaſmins* I have ſeen to blow before their leaves, and alſo after their Leaves are faln, again.

The *Sower-ſop*, a pleaſant fruit there, hath a flower with three leaves; when theſe open, they give ſo great a crack, that I have more than once run from under the Tree, thinking it all to be tumbling down.

There is a Bird, called a *Pellican*, but a kind of *Cormorant*, that is of taſte Fiſhy, but if it lye buried in the ground but two houres, it will loſe that taſte, as I have been told for certain.

I tryed ſome *Analyſis* of Bodies by letting *Ants* eat them; and I found that they would eat *Brown* Sugar *White*, and at laſt reduce it to an *Inſipid* powder. So they reduced a *pound* of *Sallet-oyl* to *two drams* of powder.

At our firſt coming there, we ſweat continually in great drops for three quarters of a year, and then it ceaſeth: During that ſpace I could not perceive my ſelf or others more dry, more coſtive, or to make leſs Urine, than in *England*. Neither does all that ſweat make us faintiſh. If one be dry, it is a thirſt generally ariſing from the heat of the Lungs, and affecting the mouth; which is beſt cooled by a little *Brandy*.

Moſt Creatures drink little or nothing there, as Hogs; nay, Horſes in *Guanaboa* never drink; nor Cows in ſome places of the Iſland for ſix *months*; Goats drink but once perhaps in a week. Parrots never drink, nor Parrokets; nor Civet-Cats, but once a month.

The hotteſt time of the day to us, is Eight in the morning, when there is no *Brize*. I ſet a weather-glaſs in the window, to obſerve the weather, and I found it not to riſe conſiderably at that time, but by two of the clock it roſe two inches.

Venice Treacle did ſo dry in a Gally-pot, as to be friable; and then it produced a Fly, called a *Weavil*, and a ſort of white-worm. So did the *Pilulæ de Tribus* produce a *Weavil*.

I ſhall

I ſhall conclude with an obſervation of a ſtrange Quality of a piece of Land : There is in the midſt of the Iſland a Plain, called *Magotti Savanna*, in which whenſoever it rains (and the rain paſſes along the Iſland, before it falls there) the rain, as it ſettles upon the ſeams of any garment, turns in half an hour to Magots ; yet is that *plain* healthful to dwell in ; and an hundred, that have ſeen the thing, aſſured me of it.

Infinite might the obſervations be, if I had alwaies enjoyed my health, for the ſpeculative Philoſophers ; almoſt every thing there being new, and Nature being luxuriant in her Productions in thoſe parts : But I ſhall not trouble you with imperfect memorials, *&c.*

So far this curious Obſerver ; whoſe laudable Example may both quicken and direct other Travellers in the Particulars, to be taken notice of in their Voyages.

Extract of a Letter, written by Mr. Sam. Colepreſs *to the Publiſher, containing an Account of ſome Magnetical Experiments ; as alſo of an excellent Liquor made of Cyder-apples and Mulberries.*

Preſuming, what e're tends to the farther diſcovery of the *Magnetick* vertue, will not be unwelcome to you, encouraged by a hint, given in *pag.* 423. of your *Phil. Tranſact.* I ſhall not ſcruple to relate to you two or three Experiments of mine own, performed in the preſence of Sir *William Strode.*

1. I took a Loadſtone unpoliſh'd, which attracted but meanly; and I heated a Lath-nail glowing hot, nimbly applying the North-pole of the ſaid Magnet to it, which quickly took it up, and held it ſuſpended a great while, till I put down both the Magnet and Nail.

2. I took the ſame ſtone, and caſt it into the Fire, letting it remain there, till it was thorow hot, altering its colour from black to red, and being red-hot, I applied the North pole to another Lath-nail cold, and untoucht before, which it took up, but faintly, yet held it ſuſpended for ſome time.

3. Two or three daies after, I took the ſame Loadſtone, and found, that it attracted then as ſtrongly, as before it was caſt into

into the Fire. Whence I inferr'd, that the Fire ſomewhat leſſen'd its Attractive faculty, but did not deprive the Stone of it.

Cyder-ſeaſon approaching, I know not how to conceal from the delicate and curious Cyder-drinker (though I my ſelf find the pleaſures of all liquors in one, even that of fountain water*) the notice of a liquor as commendable, as yet rare. It is a compoſition of the Juyces of good Cyder-apples and Mulberries, producing the beſt taſted and moſt curiouſly coloured liquor, that many ever ſaw, or taſted. Of which the experiment may be eaſily made by thoſe that are furniſht with Mulberry-trees, without any conſiderable coſt.

* This Gentlemans conſtant drink is Spring-water.

An Account of ſome Books.

I. *The HISTORY of the ROYAL SOCIETY of LONDON, for the Advancement of EXPERIMENTAL Philoſophy, by THO. SPRAT.*

IT was indeed highly ſutable, that the *Hiſtory* of the *Royal* Experimenting *Society* ſhould be dedicated, as the Candid *Author* of it hath done, to that *King*, who is the *firſt* of all the Kings of *Europe*, that confirmed this Noble Deſign of *Experiments*, both by His own Example, and by a publick Eſtabliſhment.

The Diſcourſe it ſelf, which is modeſt and elegant, is divided by the Author into theſe three general Heads:

The *Firſt* gives a ſhort view of the *Ancient* and *Modern* Philoſophy; and of the moſt Famous Attempts, that have been made for its *Advancement*, by the *Chaldeans*, *Egyptians*, *Grecians*, *Arabians*, *Romans*, of old; and then, by ſeveral *New naies* of *Philoſophy*

Philoſophy, in the compaſs of our memories, and the Age before us, repreſenting what hath been attempted by the *Modern Dogmatiſts*, the *Revivers of Ancient Sects*, the *late Experimenters*, the *Chymiſts*, and the *Writers* of *Particular Subjects*: All which he deduceth, to the end, that by obſerving, wherein others have *excelled*, and wherein they have been thought to *fail*, he might the better ſhew, what is to be expected from theſe new Undertakers; and what moved them to enter upon a way of Inquiry, different from that, on which the former have proceeded.

The *Second*, conſiſts of the *Narrative* it ſelf; in which the *Hiſtorian*, out of the *Regiſters* and *Journals* of the *Royal Society* (which he hath been permitted to peruſe) relateth the *firſt Occaſions* of their Meetings, the Encouragement and *Patronage* they have received; their *Patent*, their *Statutes*, the whole Order and *Scheme* of their *Deſign*; the *Qualifications* of their *Members*; the *Largeneſs* of their *Number*; Their *weekly Aſſemblies*; the *manner* of their *Inquiry*; their *way* of Regiſtring; and their *Univerſal Correſpondency*; together with a *Particular Enumeration* of the *Principal Subjects*, about which they have been employed, ſince they were made a *Royal Corporation*, and this, to ſilence that importunate demand, *What they have done all this while?* And here the *Hiſtorian* hopes, that all *reaſonable* men will find ſatisfaction, when they ſhall conſider, *Firſt*, That, beſides that this *Society* hath paſſed through the firſt difficulties of their *Charter*, and *Model*, and overcome all oppoſitions, which uſe to ariſe againſt the *beginnings* of *great things*; their Aim, and the Nature of their Deſign, and the Extent of their task do admit of no violent and haſty diſpatch. *Next*, That, though their work hath not been expoſed to open view, yet their *Regiſters* are ſtored with a good number of *Particulars* they have taken pains about; As,

1. *Queries*, and *Directions*, they have given abroad.
2. *Propoſals*, and *Recommendations*, they have made.
3. *Relations*, they have received.
4. *Experiments*, they have tried.
5. *Obſervations*, they have taken.
6. *Inſtruments*, they have invented, or advanced.

7. *Theories*,

7. *Theories*, that have been propoſed.

8. *Diſcourſes*, they have written, or publiſhed.

9. *Hiſtories* of *Nature*, and *Arts*, and *Works*, they have collected.

The *Particulars* upon which *Heads* are more numerous, and of greater moment and variety, than perhaps Detractors and Cavillers imagine or expect: they exceed indeed the number of 700; of which the *Experiments* and *Obſervations* both together amount to above 350; the *Relations*, to about 150; the *Queries*, *Directions*, *Recommendations*, and *Propoſals*, to above 80; the *Inſtruments*, to about 60; the *Hiſtories* of *Nature* and *Art*, to above 50; and the *Theories* and *Diſcourſes*, to as many.

To theſe he adds an Account of the *Library* and *Repoſitory*, they have obtain'd by the bounty of two of their Members; and gives withall ſome *Examples* of their *Experiments*; *Hiſtories* both of *Nature* and *Art*; *Queries* anſwered; *Propoſals* recommended, *&c.* Which done, he concludeth, That if any ſhall yet think, they have not uſefully employed their time, he ſhall be apt to ſuſpect, that they underſtand not, what is meant by a *diligent* and *profitable labouring* about *Nature*; and that ſuch men ſeem not capable of being ſatisfied, unleſs the Gentlemen of this *Society* immediately profeſs to have found out the *Squaring of the Circle*, or the *Philoſophers Stone*, or ſome other ſuch mighty *Nothings*; which only argues the extravagance of the Expectations of ſuch men. Mean time, the *Author* eſteems, that, ſince the Society promiſes no Miracles nor endeavours after them, and ſince their Progreſs ought to be equal and firm, by Natural degrees, and thorow *ſmall* things, as well as *great*, going on leiſurely and warily, it is therefore fit, that they alone, and not others, who refuſe to conſider the *nature* of their *work*, and to partake of their *burthen*, ſhould be Judges by what ſteps and what pace they ought to proceed.

The *Third* Part, is aſſerting both the *Advantage* and *Innocence* of this Deſign, in reſpect of all *Profeſſions*, and particularly of *Religion*; and how proper, above others, it is for the preſent Temper of the *Age*, wherein we live: And

this is done, to free it from the *Cavil* of the *Idle*, and *Malicious*; and from the *Jealouſies* of *Private Intereſts*; all which the *Author* ſhews to have nothing but *Humour*, or *Envy*, *Prejudice*, or *Miſtake*, to bear themſelves upon.

The promoting of *Experiments*, according to the *Model* of the *Royal Society*, will be ſo far from injuring *Education*, or from being dangerous to the *Univerſities*, that it will both introduce many things of greater concernment and benefit, to ſupply the place of what may be laid aſide; and be mainly conducive to recover that Divine *Dignity* of *Humane Nature*, which conſiſts in the *Knowledge* of *Truth*, and the *Doing of Good*.

The *Firſt years* of Men being ſecured by this new *Experimental* way; it is made out to all *Profeſſions* and *Practical lives*, that they can receive no ill Impreſſions from it, but that it will be the moſt beneficial and proper ſtudy for their Preparation and Direction. Whereas other Learning is charged to conſiſt in *Arguing* and *Diſputing*; and to be apt to make our Minds lofty and *Romantick*; preſumptuous and obſtinate; averſe from a practical Courſe, and unable to bear the difficulties of Action; Propenſe to things, which are no where in uſe in the world; and careleſs of their own preſent times, by doting on the paſt: This *Experimental* Philoſophy will turn men to Tryals and Works; cure their minds of *Romantick* ſwelling, by ſhewing all things familiarly to them, juſt as large as they are; free them from *perverſity*, by not permitting them to be too peremptory in their *Concluſions*: accuſtome their hands to things, which have a near reſemblance to the buſineſs of life: and draw away the ſhadows, which either enlarge or *darken* humane affairs: And of the *Crafty*, the *Formal*, and the *Prudent* (the uſual Titles, by which men of buſineſs are wont to be diſtinguiſhed:) Our Author reſembles the *Crafty*, to the *Emperick* in Philoſophy; the *Formal*, to the meer *Speculative* Philoſopher; but the *Prudent* man, to him, who proceeds on a conſtant and ſolid courſe of *Experiments*: the *one* in *Civil life*, rejecting neither the wiſdom of *Ancient*, nor that of *Modern* times; the *other* in *Philoſophy*, having the ſame reverence for *former* Ages, and regard for the *preſent*; both raiſing their

Obſervations

Obſervations unto *Uſe*, not ſuffering them to lye idle, but employing them to direct the *actions*, and ſupply the *wants of humane life*.

And as this *Experimental* way will afford much help to our *Publick duties*, and *Civil actions*, ſo it is proved to be very uſeful for the *Cure* of mens *Minds*, and the management of their *private motions* and paſſions, by keeping them from *idleneſs* with full and earneſt *employments*, and by poſſeſſing them with innocent, various, laſting, and even ſenſible *delights*.

From hence our Author proceeds to make a defence of the *Royal Society*, and this new *Experimental Learning*, in reſpect of the *Chriſtian Faith*: fully evincing, that as it is not at all dangerous to *Religion* in *general*, ſo it is not to the *Doctrine of the Goſpel*, nor that of the *Primitive Church*, or of the *Church of England*.

This done, he declares, on what account the *Study* of *Experiments* is the moſt ſeaſonable ſtudy for the preſent *Temper* of the *Engliſh Nation*; and then goes on to manifeſt the probable Effects of *Experiments*, in reſpect of all the *Manual Trades*, which have been heretofore found out, and adorned. This Argument he diſpatches in a clear Reſolution of theſe *Four* Queſtions:

1. Whether the *Mechanick Arts* are ſtill improvable by humane *Induſtry*?

2. If they be, whether they may be advanced by any others, beſides the *Mechanick Artiſts* themſelves?

3. Whether there be any ground of hope from *Experiments* towards this Work?

4. Whether, if ſuch *Arts* ſhall hereby happen to multiply, they are likely to prejudice thoſe *Trades*, that are already ſetled?

In theſe *Particulars* our Author doth ſo anſwer his *Readers* doubts, that it will eaſily be granted him, That it is not a vain or impoſſible Deſign, to endeavour the *increaſe* of *Mechanick contrivances*; that the enterpriſe is proper for a *Mixt Aſſembly* of Experienced *Naturaliſts* and *Mathematicians*: that the Courſe which the *Royal Society* obſerves towards it, will be effectual; and the *Increaſe* of ſuch *Operations*, inoffenſive to

others of the ſame kind, that have been formerly diſcovered.

Hence he proceeds to ſhew, That theſe Experiments are a proper ſtudy for the *Gentlemen* of this Nation, in which he finds them already well engaged: As alſo, that they will be beneficial to our *Wits* and *Writers*, who, if truly worthy men, will find in the *works* of *Nature* an inexhauſtible Treaſure for *Fancy* and *Invention*, which will be diſcloſed proportionably to the increaſe of their knowledge: Further, that they are advantageous to the Intereſt of the Nation, by enlarging the *Trade* and *Power* thereof.

Upon which and ſeveral other accounts (not poſſible to be contracted here) our *Hiſtorian* concludes his *Diſcourſe*, with giving us a *Catalogue* of thoſe, which at this preſent compoſe the *Royal Society*, amounting near to two hundred; whereof the King's *Majeſty* is *Founder* and *Patron*. Among the *Fellows* are three of the Greateſt Princes of *Europe*, his Royal Highneſs the *Duke* of *York*; his Highneſs *Prince Rupert*, Count Palatine of the *Rhine*; and his Highneſs *Ferdinand Albert*, Duke of *Brunſwick* and *Lunenburg*: Then, the two *Archbiſhops* of *England*, and four *Biſhops*; of *Dukes*, *Marqueſſes*, *Earls*, *Viſcounts*, and *Barons*, *Engliſh* and *Scotch*, twenty nine; of *Knights*, thirty five; of *Doctors* and *Batchellors* of *Divinity*, fourteen; of *Doctors* and *Candidates* of *Phyſick*, twenty one; of *Eſquires*, and other *Gentlemen*, and *Merchants*, ſixty four; of *Strangers*, ſixteen.

After the Enumeration of which, he recommends this *Undertaking* to the *Engliſh Nation*; to the *braveſt people*, the moſt *generous Deſign*, which at once regards the *diſcovering* of *New ſecrets*, and the *Purifying* and *Repairing* all the profitable things of *Antiquity*: and here he repreſents, that if now this *Enterpriſe* ſhould chance to fail for want of *Patronage* and *Revenue*, the World would not only be fruſtrated of their preſent Expectations, but have juſt ground to deſpair of any *future* Labours, towards the increaſe of *Practical* and *Uſeful* knowledge. But he hopes and preſages, that the *Engliſh* Nation will lay hold on this opportunity, to deſerve the Applauſe of *Mankind*, for having encouraged and ſupported a *Work*, which, inſtead of barren

barren *Terms* and *Notions*, is able to impart to us the *Uſes* of all the *Creatures*, and to enrich us with all the Benefits of *Real* Knowledge, true *Honour*, great *Plenty*, and ſolid *Delight*.

II. *DISQUISITIO ANATOMICA DE FORMATO FŒTU*: *Authore* Gualtero Needham *M. D.* Londini, *in* 8°.

THis *Diſquiſition* conſiſts of ſeven *Chapters*, full of the Learned and Ingenious Author, who was lately elected a Fellow of the *Royal Society*, his own Experiments and Obſervations.

In the *firſt* he inquires into the *Paſſages*, by which the *Nouriſhing Juyce* is conveighed to the Womb of the Animal: where he examines the Aſſertion of *Everhard*, importing, that ſome of the *Lacteous* Veſſels carry the ſaid Juyce to the *Uterus*; which veſſels are pretended to have been ſeen by himſelf in the diſſection of *Rabbets*. Which engaged our Author to take up again the Anatomical knife, and to diſſect with all poſſible accurateneſs both ſome of the bigger Animals, as *Cowes* and *Mares*, and ſome of the ſmaller kind, as *Rabbets*, which are inſtanced by *Everhard*.

But having ſpent all his labour and care herein in vain, and beſides, evinced by *Ligatures*, that the pretended Veſſels are neither thoſe that are deſcribed by *Bartholin* under the name of *Lymphatick*, nor others, preſumed to be known by *Everhard* alone, as immediately carrying the *Chyle* out of its *Receptacle* to the *Womb* and *Breaſts*; he imputes the cauſe of this miſtake to the *Trunk* of the *Lymphaticks*, running over the *Vena cava* into the *Receptacle* near the *Emulgents*, which *Ductus* he affirms to have often found filled with Chyle from the *Inteſtinum Rectum*, or the *Ileum*, or *Cæcum* (a Dog having no *Colon*;) but maintains withall, that by *Ligatures* it is manifeſt, that that *Ductus* goes to the *Receptacle*, and there depoſites its liquor; which he proves to be alike true of all the *Milky veſſels*, ſo that they carry nothing back, and conſequently are unfit to conveigh any thing to the Womb. This he illuſtrates by a Noble

Noble Experiment of that Learned and Expert Anatomiſt, Dr. *Lower*, uſing to open ſometimes the right ſide of the *Thorax*, and with his fingers to break the *Receptacle*; and ſometimes on the left ſide, the *Ductus Thoracicus*, a little under the *Subelaviar*; whereby it hath come to paſs, that Dogs, well fed all the while, have thrown out all the Chyle into the opened part of the *Thorax*, and, though plentifully fed, were ſtarved within three daies: there appearing mean time in the Veins opened a craſs bloud, deſtitute of *Serum*, but not any mixture of tranſmitted Chyle.

Having rejected the *Lacteous* and *Lymphatick* veſſels from this office, he declareth, that we muſt reſt in the Ancient Doctrine, which layeth the task of conveighing the *Succus nutritius*, to the *Breaſts* and *Womb*, upon the *Arteries*; unleſs the *Nerves* be call'd in for aid, for conveighing ſome of the *Spirituous* Juyce, to be mixed with the *Nutritious*, to give life and vigour; And having proved this, he takes notice of the multitude of *Anaſtomoſes*, remarkable in the womb of pregnant Creatures; and ſubjoyns a diſcuſſion of the way how the *Alimental Juyce* is in the womb ſevered from the maſs of the *bloud*: whether by *meer Percolation*, or by ſome *Ferment*, working upon the Bloud, and thence precipitating what is proper for the uſe of that part.

In the *Second* Chapter he treats of the *Placenta's* and *Glandules*, and ſhews, How many waies the *Juyce* is derived from the Womb to the *Fætus*: Firſt, ſimply from the Membrane of the *Uterus* to the Membrane of the *Fætus*; as in all *Oviparous* Creatures; and among *Viviparous*, in a *Sow*, all the time of her bearing; in a *Mare*, for half the time; and in a *Woman*, the firſt month only. *Secondly*, By a *Maſs of fleſh*, filtring the Juyce; as in all *Cake-bearing* (called by the Latines, *Placentifera*) and in all *Kernel-bearing* (called *Glandulifera*) or *Ruminating* Animals. Where he giveth a particular account of the double *Placenta* or *Cake*, to be found in *Rabbets*, *Hares*, *Mice*, *Moles*, &c. and examines the learned Dr. *Whartons* Doctrine, aſſigning a double *Placenta* to at leaſt all *Viviparous* Animals, ſo as one half of it belongs to the *Uterus*, the other, to the *Chorion*: ſhewing how far this is true, and declaring

declaring the variety of theſe *Phænomena*, together with a very ingenious aſſignation of the Cauſe of that variety. Where do occur many un-common Obſervations concerning the *difference* of *Milk* in ruminating and other Animals; the *various degrees* of *thickneſs* of the *Uterin liquor* in Oviparous and Viviparous creatures; the property of the humour, turning into Eggs, with a hint of the cauſe of their being excluded, and not quickned and formed within; as alſo, of the cauſe of *Moles* in the womb, and of many kernelly and fleſhy ſubſtances in other parts of the body: where he takes notice of a concretion ſeen by himſelf grown to the *Cone* of the Heart, of nine ounces weight in an healthy Body, that died of a violent death; and of the like adhering to the *Spleen*, *Kidneys*, *Liver*, without any perceived trouble to the Animal; yea, of ſome found *within* the *heart* it ſelf.

He adds the *Number*, *Shape*, and *Uſe* of theſe *Placenta's*; and *firſt* obſerves, that thoſe that are *Kernel-bearing* Animals, or chewing the Cud, have many; and thoſe that are *Cake-bearing*, have, for the moſt part, one *Cake* for each *fœtus*; but a woman commonly but *one*, though ſhe happen to have many *Embrio's*.

He annexes a particular deſcription of the *Placenta* of a Woman, as the moſt conſiderable, and teaches, how it may be moſt conveniently ſevered from the Veſſels, to render them conſpicuous, which are a numerous off-ſpring of Arteries, Veins, and Fibres; of the laſt whereof he inquires, whether they be the capillary's of the Arteries, and Veins, or nervous.

The *Shape* of that in a Woman is *Orbicular*, about a foot large, and two inches thick; one of its Superficies's, convex, but uneven, the other concave, and every where ſticking cloſe to the *Chorion*.

The *Uſe* of the *Placenta's* is known to be, to ſerve for conveighing the aliment to the *Fœtus*. The difficulty is only about the manner. Here are examined three opinions, of *Curvey*, *Everhard*, and *Harvey*. The two former, do hold, that the *Fœtus* is nouriſhed only from the *Amnion* by the Mouth; yet with this difference, that *Courvey* will have it fed by the Mouth when it is perfect, but, whilſt it is yet imperfect, by filtration only through

through the pores of the body, and by a kind of juxta-poſition: but *Everhard*, ſuppoſing a ſimultaneous formation of all the inſtruments of nutrition together at firſt, and eſteeming the Maſs of bloud by reaſon of its aſperity and eagerneſs unfit for nutrition, and rather apt to prey upon, than feed the parts, maintains; that the liquor is ſucked out of the *Amnion* by the mouth, concocted in the ſtomack, and thence paſſed into the *Milkie* veſſels, even from the beginning. Mean time they both agree in this, that the *Embrio* doth breath, but not feed, through the Umbilical veſſels.

This our *Author* undertakes to diſprove; and having aſſerted the mildneſs of, at leaſt, many parts of the bloud, and conſequently their fitneſs for nutrition, he defends the *Harveyan* doctrine, of the *Colliquation* of the *Nouriſhing Juyce* by the Arteries, and its conveyance to the *fætus* by the veins.

In the *third* Chapter, the *Membranes* and *Humours* of *Embryo's* are conſidered. The *Membranes* are in ſome, three, in others, four, in an Egg, ſix. All *Placentiferous* Animals (if I may aſſume this word) he affirms to have three *Membranes*, and *Sows*, *Mares*, and *Women* alſo; but only two *Humours*. Again, *Bitches*, *Cats*, and *Conies*, four *Membranes*, and three *Humours*; ſo that the Number of the *Membranes* hath been hitherto obſerved alwaies to exceed that of the *Humours*.

Giving the Hiſtory of both, he begins from *Sheep*, *Cows*, and other *Ruminating* Animals, deſcribing *firſt* the *Chorion*, aſſigning its *Uſe*, and comparing it with that in *Dear*, *Sows*, *Mares*, *Women*, *Rabbets*, *Bitches*, and *Cats*, when with young. Then he proceeds to the deſcription of the *Allantoides* (the Membrane immediately encompaſſing that skin, wherein the *fætus* is wrapped) and thence to that of the *Amnion*, wherein the *Embryo* it ſelf lyeth, ſwimming in its alimental liquor. And *laſtly* to that which is obſerved to be in *Bitches*, *Cats*, and *Rabbets*, and contains a very good and nouriſhing Juyce; which how it comes thither, is a difficult inquiry, as well as that other, how the liquor gets into the *Amnion*. To reſolve both which our *Author*, having diſproved the Filtration of the liquor, held by *Courvey* and *Everhard* out of the *Chorion* into the *Amnion*, and evinced, that the liquor in the *Allantoides*, interjected between

theſe

thoſe two, is *Urinous*, he concludes, that the alimentary Juyce paſſes through the Umbilical veſſels, by a proper *Artery*, depoſiting it in thoſe *Membranes* we ſpeak of, and reſerving it there for the uſe of the *Fætus*.

Concerning the *Humours*, he affirms, that all of them in all Animals are *Nutritive*, except that in the *Allantoides*. He obſerves alſo, that moſt of *Oviparous* Fiſhes have Eggs, or Spawn, as to ſenſe of one only colour, and but one humour; yet that the Spawn of a *Skate* hath a White and a Yolk. *Birds* have moſtly three nutricious ſubſtances, that are viſible, *viz.* a Yolk and a double White: to which upon incubation, comes a fourth, colliquated out of the former; the tender *Embryo* feeding upon the two Whites, till, they being conſumed, the Yolk of the Chick, now to be hatcht, is ſhut up in the *Abdomen*, and thence by a peculiar *Ductus* conveighed into the guts; and ſo ſerves the young bird for breaſts, it is fed by, untill the twentieth day.

In *Viviparous* Creatures are found ſometimes two, ſometimes three humours, and in *Bitches*, *Cats*, and *Rabbets*, four; which perplexeth the Author, as to the giving a reaſon for it. Theſe *Humours*, he ſaith, he hath examined, by concreting, diſtilling, and coagulating them; where he furniſhes the *Reader* with no vulgar Obſervations. He concludes this *Chapter* by obſerving, that there is alſo *Air* in the ſaid *Membranes*; which beſides other Arguments, he proves from the crying of Infants in the Womb (of which he alledges a memorable and well atteſted example in a Child of an Engliſh Lady in *Cheſhire*, the Child being yet alive and in good health;) and from Chickens, often heard to peep in the Egg, both before the breaking of the ſhells, and after, the Membranes being yet entire; adſcribing the production of this Air to the ſpirituous liquor in the Membrane, apt to ferment, and thereby cauſing ſtore of exhalations.

The *fourth* Chapter diſcourſes of the *Umbilical Veſſels*; and obſerves *firſt*, that they differ in different Animals, and hold proportion to the *Membranes* and *Liquors*, ſo as thoſe that have two Liquors, have four Membranes, and three Liquors have ſix: the *Oviparous* alſo being furniſhed with a *Ductus*, paſſing to

the Guts, becauſe they want breaſts, and their yolk is ſhut up in the belly.

The *Umbilical Arteries*, belonging to the *Placenta*, and commonly ſaid to be derived from the *Crurals*, are by him affirmed to proceed from the end of the *Aorta*. They are here deſcribed, and their ſeveral portions diſtributed for the *Chorion* and *Amnion*. Then an account is given of the *Hepatick Vein*, correſponding to the Arteries. It is in Viviparous Animals inſerted into the *Vena porta*, paſſing again with the remaining bloud thorow the *Canalis Venoſus* into the *Cava*, without percolation made in the Liver. In *Birds* it enters not into the Liver, but paſſes over its convexity into the *Cava*. A deſcription alſo is made of the *Urachus*, found in all *Viviparous* Creatures, though by many Writers denied to be in *Man*, who notwithſtanding hath need, as well as other ſuch Animals, ſomewhere to lodge his Urine. The *Oviparous* want this Umbilical *funiculus*, but yet are furniſhed with fit ſanguineous veſſels, which here alſo are explained; eſpecially the *Ductus Inteſtinalis*, ſaid to be omitted by Dr. *Harvey*, and to have been known to the *Author* long before Mr. *Steno* claimed the diſcovery of it; for which he appeals to the teſtimony of Mr. *Boyle*, and three worthy Phyſicians, *Willis*, *Millington*, and *Lower*; as alſo to that of two ingenious *Frenchmen*, *Guiſon*, and *Fiard*, to whom our *Author* affirms to have ſhewed *Anno* 1659, when they were going over into *Holland*, not only this *Ductus*, but alſo the *Ductus Salivales*, and the *Paſſages* of the *Noſtrils*, publiſhed afterwards by the ſaid *Steno*.

The uſe of this *Ductus Inteſtinalis* is eſteemed to be, the conveighing of the *Yolk* into the *Guts* for a *ſecond* coction, there made by the *Pancreatick* Juyce, acknowledged to be excellently handled by the Learned *Sylvius*, and his ingenious Schollar, *De Graeff*; from the former of whom our *Author* yet diſſents, about the mixture of the Gall with the ſaid juyce in the Heart, refuting it by ſeveral Experiments.

The *fifth*, explains the Communion of Veſſels in *Embryo's*: In whom, he ſaith, three *Anaſtomoſes* are uſually obſerved, which, as ſoon as the *Fætus* is born, are cloſed. They are called, *Foramen Ovale*, *Canalis Arterioſus*, and *Venoſus*. The two former

to

to be met with about the *Heart*; the laſt in the *Liver*. All three here deſcribed by the *Author*, who alſo compares, as *Harvey* does, the *Fætus* yet in the Womb with the manner of operation of thoſe Animals, that are provided but with one cavity in the Heart, and with no Lungs; the bloud of the *Fruit*, as long it is unborn, paſſing neither through the *Parenchyma* of the Lungs, nor that of the Liver. Laſtly, The neceſſity of *Reſpiration* is explicated, and how the defect of Lungs, and of one of the Ventricles of the Heart, is ſupplied in *Fiſhes, viz.* by comminuting and mixing the Bloud in the *Gills*. To which is annexed the manner of Reſpiration in *Amphibia's*, which are furniſht with Lungs and two Ventricles of the Heart, and yet, if *Bartholin* misinformes us not, keep the *Foramen Ovale* all their life time open; which yet our *Author* calls in queſtion, alledging, to have ſeen no *Diving* Animals, which had not the ſaid *Foramen* cloſed after their being born.

The *Sixth* makes a digreſſion, to diſcourſe of the *Biolychnium*, and the Ingreſs of the Air into the Bloud, for the Generation of Spirits, and the pretended kindling of a *vital Flame*. But our *Author* can ſee nothing that may prove either the *exiſtence*, or the *neceſſity* of ſuch a Flame: On the contrary, he finds the Bloud unfit for taking Fire, and judgeth it very difficult to aſſign either the place or the manner of this accenſion; which is not made in the Lungs, nor in the Heart, which he holds to be deſtitute of all ferment. To which he adds, *firſt*, that the Heat of the Bloud is not ſufficient to cauſe ſuch an inflammation, ſeeing how much even good *Spirit of Wine* muſt be heated, before it will flame, which it doth not without the actual application of fire. *Next*, That Examples are very rare of Liquors kindled by ventilation. *Further*, That *Fiſhes* and *Frogs*, which yet have life, motion, and ſenſe, are not thought to have this flame, as being actually cold. *Beſides*, That the *Animal* Spirits are not found in the form of flame; which he endeavours to prove from the *Williſian* doctrine of the manner, in which they are in the Brain ſevered from the Bloud. *Laſtly*, That it is doubted by ſome, whether any Air at all is received into the maſs of bloud, which yet is not queſtioned by our *Author*, who only doubteth,

eth, whether through the *Lungs* there be a *high way* for the Air to the Bloud.

After this, our *Author* gives his thoughts both of the true *Use of the Lungs*, and of *Sanguification*.

The *Lungs*, he saith, serve chiefly, by their constant agitation to comminute the bloud, and so to render it fit for a due circulation; which office he thinks to be performed in *Fishes* by the continual motion of their Gills, a *Succedaneum* to Lungs.

Sanguification, according to him, is chiefly performed and perfected by the frequent pulsions of the Heart, and the repeated contractions of its left *Ventricle* at the passing of the Sanguineous liquor from thence into the *Aorta*.

The *Seventh* and *last* Chapter contains a Direction for the younger *Anatomists*, of what is to be observed in the dissection of divers Animals with young: and *first*, of what is common to all the *Viviparous*; then, what is peculiar to several of them, as a *Sow*, *Mare*, *Cow*, *Ewe*, *She-Goat*, *Doe*, *Rabbet*, *Bitch*, and a *Woman*: *Lastly*, What is observable in an *Egg*, *Skate*, *Salmon*, *Frog*, &c.

All is illustrated by divers accurate Schemes.

III. *ELEMENTORUM MYOLOGIÆ Specimen; seu MUSCULI descriptio Geometrica, Authore NICOLAO STENONE.*

THis Book is not yet come into *England*; only the Excellent *Septalio* having in his Letter above-mentioned given us notice of its being published, and dedicated to the *great Duke* of *Tuscany*, we thought it not amiss to inform the Curious of it.

Errata.

Page 489. line 9. dele, *the structure of*. p. 490. l. 23. read, *any thing then*. p. 493. l. 2. r. *principal*. p. 494. l. 19. r. *in Moravia*. p. 499. l. 6. r. *and the brise spends*.

LONDON, Printed by *T. R.* for *John Martin*, Printer to the *Royal Society*, and are to be sold at the sign of the *Bell*, a little without *Temple-Bar*. 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, *October* 21. 1667.

The Contents.

An Account of more Tryals of Transfuſion, *accompanied with ſome Conſiderations thereon, chiefly in reference to its Cautious Practice on* Man; *together with a farther Vindication of this* Invention *from Uſurpers. The* Method *of Transfuſing into the Veines of* Men. *Anſwers to ſome of the* Inquiries *formerly publiſht concerning* Mines. *An Extract of a Letter ſent from* Paris *about the* Load-ſtone; *where chiefly the ſuggeſtion of* Gilbert *touching the Circumvolution of a* Round Magnet, *and the* Variation *of the* Variation *is examined. An Account of ſome Books and ſmall Tracts:* I. FREE CONSIDERATIONS *about* SUBORDINATE FORMS, *by* ROBERT BOYLE *Eſquire.* II. JOH. SWAMMERDAM, M.D. *de* RESPIRATIONE *&* USU PULMONUM. III. OBSERVATIONS *faites ſur vn* RENARD MARIN, *&* *vn* LYON, *à* Paris. IV. HISTORIA AMBRÆ GRISEÆ, *Auth.* JUSTO KLOBIO, D.

An Account

Of more Tryals of Transfuſion, *accompanied with ſome* Conſiderations *thereon, chiefly in reference to its circumſpect Practiſe on* Man; *together with a farther* Vindication *of this* Invention *from Uſurpers.*

THis Experiment, as it hath raiſed Diſputes among the *Curious*, both here and abroad; ſo it hath put ſome of them upon conſidering ſuch wayes, and giving ſuch cautions, as may ren-

der the uſe of it ſafe and beneficial. Of the number of theſe ſeems to be that *French* Virtuoſo, *Gaſper de Gurye de Montpoly*, who in a late *Letter* of his to Monſieur *Bourdelot*, declares to the World, that this is a very Ingenious Invention, and ſuch an one, as may prove very uſeful; but withall, that, in his opinion, it is to be uſed with much caution, as not being like to be practiſed innoxiouſly, if imprudent men do mannage it, and the concourſe of two differing ſorts of Blood requiring many tryals, and a careful obſervation of many circumſtances, to give aſſurance. He ſuppoſes, that the Blood of every Animal is endowed with its peculiar Temper, and contains in the Aggregate of its parts, different natures, principles, figures, and even a different Centre. Whence he concludes, that two Subſtances thus differing, and containing plenty of Spirits, are not reducible to one and the ſame Centre, nor to one and the ſame Body without *Fermentation*; and that this Operation may prove of danger to him, that ſhall have admitted into his Veins a ſtrange Blood (wont to be free in its native veſſels) without paſſing through thoſe degrees, that muſt give it Impreſſions ſutable to the temper and Functions of the Vitals of the *Recipient*. And taking for granted, that no conſiderat man will hazard a *Total* Transfuſion, he acknowledges that a *Partial* one may be in ſome caſes and ſickneſſes very uſeful, provided, it be practiſed circumſpectly, upon a Body yet ſtrong enough, and in a *moderate* quantity, ſo as the Spirits and Blood of the *Recipient* may be able to diſſolve and maſter the transfuſed ſtrange Blood, and convert the ſame into its own nature by a gentle *Ebullition*; to obtain by ſuch a commixture a principle of motion, that may cauſe a better habit of Body. And he believes, that this Ebullition muſt alwayes happen in Bloods of differing parts and qualities; and that very hardly two Animals, of differing ſpecies's, ages and tempers, will be met with, that have Blood ſo like one another, as not to need *Fermentation*, to make a requiſit mixture. He doubts not, that if a ſubſtance could be found ſo reſembling that of our Spirits, as that it would immediately unite it ſelf with them, not needing any alteration, the Transfuſion of ſuch a Subſtance would be capable to produce effects little leſs than miraculous, by relieving the proſtrated

forces

forces of Nature, and by fortifying in us the Spring of motion and life: In a word, by exciting that Principle of continual Motion, which, whilſt it has ſtrength enough, ſtill ſubdues and gathers to its ſelf whatever is proper to entertain it, and rejects what is not ſo. But ſuch an Invention as this he ſees cauſe to eſteem very difficult, in regard that *different* Moulds cannot but Characterize things *differently*. Hence he proceeds to the Examples, wherein *Transfuſion* hath been experimented, even upon *Men*; alledged in that known ingenious Letter of Monſieur *Denys*. And here he intimates, how much he was pleaſed to learn, that, according to his Conjecture, a *Moderate* Intromiſſion of Blood had well ſucceeded, and the *Fermentation*, which he foreſaw would be cauſed by the commixture of two Bloods, was made with advantage to the Patient: VVhich he judges did manifeſtly appear by his Bleeding at the Noſe, (a ſigne of an *Ebullition* made in the Blood:) confirmed to him by this, that an expert Acquaintance of his, transfuſing a great quantity of Blood into ſeveral Doggs, obſerved alwayes, that the *Receiving* Doggs piſſed Blood.

And as to the other ſucceſsful Experiment, made upon a healthy and robuſt man, he notes, that he being a luſty Fellow, ſtored with blood, and taking the Air, and working hard on the ſame day that the tryal was made upon him, his vigorous Blood, Spirits, and Conſtitution, and the ſtrong motion of his Heart, were able to convert into the ſubſtance of his own Blood that of the *Lamb* received, and to impart thereto its own nature, and to mould it into Figures ſutable to the pores where it was to paſs, and proper to the functions it was to performe.

But to theſe Reflections he ſubjoyns two other *Inſtances*, of an unlike ſucceſs; whereof the one is afforded by a *Man*, the other by a *Dogg*. As to the *Man*, it ought to be related beforehand, to prevent wonder or miſconſtruction, that his Inteſtins, when he was opened after death, were found to be gangren'd, and conſequently, that then he appeared to have been a ſubject altogether unfit for this Experiment, ſeeing it was naturally impoſſible for him to live with ſuch a putrefaction. But to come to the tryal it ſelf; this *Author* ſaith, that Baron *Bond*, Son to the firſt Miniſter of State to the King of *Sweden*, undergoing the

Operation twice, appeared the first time to find new strength by it; but expired soon after the second Operation: * The Ebullition, it seems, of the corrupt Blood having mastered and enervated all the Blood he had in his Body: which, when open'd, no Blood at all was found in his Heart: probably, as the *Author* conjectureth, upon this account, that there being not left in the *Patient* Blood enough of his own, nor strength sufficient to turn a strange Blood into a substance homogeneous to *that*; the Heart was not capable to admit the Blood of the *Emittent*, as consisting of parts disproportionate to his own. But, as has been already observed, his Entrails were altogether vitiated by a *Gangrene*, and he therefore out of the reach of being relieved by this Experiment.

* It were to be wished the *Author* had expressed the Interval of time, wherein these two operations followed one another; *that* seeming to be a material circumstance in the Case.

Concerning the other *Instance*, *viz.* of the *Dogg*, the *Letter* affirms, that that Tryal was made by Monsieur *Gayen* with great exactness, after this manner. He drew three great dishes of Blood from the Dog that was to receive, and weighed the other Dog that was to furnish; and, the operation being perform'd, he weighed him again, and found him weigh less than he did by *two* pounds; of which, having abated an *ounce* more or less, for the Urine, made by the Dog, and an *ounce* or *two* more for the Blood spilt in the Operation, there remained at least *one* pound and a *half* of Blood, that was transfused. But, the *Recipient*, though well dress'd, and well fed, died *five* dayes after, the *Emittent* being yet alive. Whence it seems evident to this *Writer*, that the *too large* Intromission of *new* Blood was predominant over the *Native*, and, as 'twere, overwhelm'd it. Whence he again inculcates the dangerousness of infusing *too much* Blood at once, in regard that such Blood being now separated from that Principle of life it had in the *Emittent*, and as yet destitute of the stamp necessary to live the life of the *Recipient*, it could not be moved and assimilated by the live Blood, which remained in the *Recipient*; and the *Fermentation*, that was made, passed rather to an Eagerness or Sowerness, than to such an one as precedes Digestion. And this kind of eager acidity *he intimates* was seen by the Spectators, and felt by the Receiving Animal,

which

which ſwounded, and remained as dead for half a quarter of an hour: And when ſome alledged, that the Dog died, becauſe he was wounded in the neck, where he could not lick himſelf, which rendred his wound incureable, anſwer was given, that Experiments had been made, wherein not only a Vein was opened, but alſo an Artery, yea, even the *Aſpera arteria* cut of a Dog, that could not lick himſelf, and yet ſurvived,

This whole Account is concluded with an Admonition, that all thoſe, who have conveniency, would make frequent and exact trials of this Experiment on *Brutes*, and carefully obſerve *Weight* and *Meaſure*, and all other circumſtances, before any thing be hazarded, that may damnify the publick, and depreciate the Invention.

Abundans cautela non nocet, is a Maxime very fit to be minded here; though ſeveral ſucceſful Experiments have been made in *London*, of very plentiful Transfuſions; and among others (to mention a ſignal one) that upon a *Bitch*, which loſt in the operation near 30 ounces of bloud, and was recruited accordingly. This animal does not only ſurvive to this very day, but had another more ſevere Experiment ſoon after tryed upon her, by which her *Spleen* was cut out, without tying up the veſſels, whence that *viſcus* was ſeparated: Since which time (even before the wound was healed up) ſhe took dog, was with puppy, and brought forth whelps, and remains well and jocond, being kept for a piece of remarquable Curioſity in the Houſe of a Noble-man, that is as ſevere in Examining matters of fact, as he is able in Judging of their conſequences.

So that it is not too haſtily to be concluded, that *large* Transfuſions are dangerous; but rather frequent Experiments ſhould be made, before any thing be therein determined, with great as well as ſmaller quantities, both upon ſound and ſickly Beaſts, carefully obſerving, how either is endured in either, and what are the Effects following thereon.

Before we diſmiſs this *Subject*, ſomething is to be ſaid of the Cauſe, why the Curious in *England* make a demurre in practiſing this Experiment upon *Men*. The above-mentioned ingenious Monſieur *Denys* has acquainted the World, how this degree was ventured upon at *Paris*, and what good ſucceſs it there met

with : And the *Journal des Scavans* glorieth, that the *French* have advanced this Invention ſo far, as to trie it upon *Men*, before any *Engliſh* did it, and that with good ſucceſs.

We readily grant, *They* were the firſt, we know off, that actually thus *improved* the Experiment; but then they muſt give us leave to inform them of this Truth, that the Philoſophers in *England* had practiſed it long agoe upon *Man*, if they had not been ſo tender in hazarding the Life of Man (which they take ſo much pains for to preſerve and relieve) nor ſo ſcrupulous to incurre the Penalties of the Law, which in *England*, is more ſtrict and nice in caſes of this concernment, than thoſe of many other Nations are.

The *Publiſher* can aſſert *bonâ fide*, that ſeveral Moneths agoe he ſaw himſelf the *Inſtruments* ready, and heard the *Method* agreed on, thought proper to execute this Operation upon Man. And, for further proof thereof, he ſhall here inſert the whole way, peculiarly contrived here for this purpoſe, by the Ingenious Dr. *Edmund King*, and by him communicated in a Letter; Monſieur *Denys* not having thought fit to deſcribe the *manner* they uſed in *France* for *Men*; nor any body elſe, come to our knowledge.

The Letter is as follows,

SIR,

THe Method of Transfuſing Bloud you have ſeen practiſed, with facility enough, from Beaſt to Beaſt; and we have things in a readineſs to transfuſe Bloud from the Artery *of a* Lamb, Kid, *or what other Animal may be thought proper, into the* Vein *of a* Man. *We have been ready for this Experiment theſe ſix Months, and wait for nothing but good opportunities, and the removal of ſome conſiderations of a Moral nature. I gave you a view, you may remember, a good while agoe, of the Inſtruments, I think very proper for the Experiment, which are only a* Silver Tube, *with a* Silver Stopper *ſomewhat blunted at one end, and flatted at the other for conveniency of handling, uſed already upon Beaſts with good ſucceſs. The*

way

way is in ſhort this. After the Artery is prepar'd in the Lamb, Kid, *&c. let a Ligature be made upon the* Arm, *&c. of a man (hard enough to render the Vein turgid) in the place, you intend to inſert the leſſer end of the Silver pipe, which is ſo fitted, that the Silver Stopper, thruſt into the Tube, reaches ſomewhat, by its blunt end, beyond one of the ends of that Tube. This done, divide the skin of the part in the ſame manner, that is us'd in cutting an* Iſſue, *juſt over the vein, to be open'd. Then with a fine Lance open the vein ; or, if you pleaſe, in caſe the Vein lye fair and high (eſpecially if the skin be fine) you may open both together, according to the uſual way of letting bloud. Which done, let an Aſſiſtant clap his finger, or a little boulſter, prepared beforehand, or the like, upon the Vein, a little below the Orifice, to hinder the bloud from aſcending. Keeping that poſition, inſert the blunt-ended Tube upwards into the Vein ; when 'tis in, hold it and the skin cloſe together between your finger and thumb. Then pull out of the Tube the Stopper, and inſert the Pipe, by which the Arterial bloud is to be infuſed from the* Emittent *Animal ; managing the remainder according to the known Method of this Experiment.*

So far this Letter ; which maketh the practicableneſs of this *Method* look ſo fair and eaſie, that nothing ſeems wanting to encourage the Trial, but the Direction and Aſſiſtance of diſcreet and skilful men, taking care, not to experiment it upon Subjects, that have their internal parts vitiated; for as much as it ſeems not reaſonable to expect, that this Transfuſion ſhould cure *Cacochymies*, or reſtore a depraved conſtitution of the *viſcera*.

We would have ſaid no more of this Argument at this time, were we not obliged to remove a miſtake found in one of the late *French* Journals, affirming with confidence, that 'tis *certain*, the

French

French have given the *Engliſh* the firſt *thought* or notion of this Experiment. And why? becauſe (*ſay they*) there are witneſſes, that a *Benedictine* Fryer, one Don *Robert de Gabets*, diſcourſed of it at Monſieur *de Monmors*, ten years agoe. Surely, all ingenious men will acknowledge, that the *certain* way of deciding ſuch Controverſies as theſe, is a Publick Record, either written or printed, declaring the time and place of an Invention firſt propoſed, the contrivance of the Method, to practiſe it, and the inſtances of the ſucceſs in the Execution. All this appears in the field for *England*.

Numb. 7. of theſe *Tranſactions* (printed *An.* 1665. *in Decemb.*) acquaints the World, how many years ſince Dr. *Chriſtopher Wren* propoſed the Experiment of *Infuſion* into Veins. And this was hint enough for the *R. Society*, ſome while after to advance *Infuſion* to *Tranſfuſion*; for the trial of which latter, they gave order at their Publick Meeting of *May* 17. 1665. as may be ſeen in their *Journal*, where 'twas regiſtred by the care of their Secretaries, obliged by Oath to fidelity: The trials proving *then* lame, for want of a fit *apparatus*, and a well contrived *Method* of operation, the Learned Phyſitian and Expert Anatomiſt, Dr. *Lower*, ſince found out ſuch a Method, which is not only regiſtred in the ſame Book, but alſo publiſhed in Print *Numb.* 20. of theſe *Tracts*; before which time it had been already practiſed by the ſaid *Doctor* in *Oxford*, who was followed by ſeveral ingenious men at *London*, that ſucceſsfully practiſed it by the Publick Order of the aforeſaid *Society*.

It ſeems ſtrange, that ſo ſurpriſing an Invention ſhould have been conceived in *France*, as they will have it, ten years ago, and lain there ſo long in the womb, till the way of Midwiving it into the world was ſent thither from *London*: To ſay nothing of the diſagreement, there ſeems to be about the French *Parent* of this *fœtus*, Monſieur *de Gurye* in the Letter above mentioned, fathering it upon the *Abbot Bourdelot*, but the Author of the *French Journals*, upon a *Benedictine Fryer*.

But whoever this Parent be, that is not ſo material, as that all that lay claim to this Child, ſhould joyn together their endeavors and cares to breed it up for the ſervice and relief of humane life, if it be capable of it; And this is the main thing aimed at and ſollicited in this Diſcourſe; not written to offend or injure

any,

any, but to give every one his due, as near as can be diſcerned by the *Publiſher*.

Anſwers
To ſome of the Inquiries *formerly publiſh'd concerning* Mines.

THat the *Quæries*, ſcattered up and down in theſe *Tracts*, may not ſeem loſt, or left un-regarded, the *Publiſher* intends to impart at convenient times ſuch of the Anſwers, ſhall be ſent in by obſerving men, as may be thought acceptable to the *Reader*.

He begins now with an Account, communicated to him by the Learned and Inquiſitive Mr. *Joſeph Glanvil*, who premiſes in a *Letter*, that he procured the following *Anſwers* from a Perſon living near the *Mendip*-Mines, and upon whoſe relations we may ſecurely depend: Adding, that he does not by theſe few ſuggeſtions think himſelf abſolved of his Taske, but ſhall purſue the matter farther, as ſoon as he has an opportunity of going into theſe Parts, whence he exſpects to be farther inform'd.

The *Reader* will be pleaſed to look back to the ſaid ſeveral *Queries*, as they are extant in the *Number* 19; the following *Anſwers* reſpecting thither, and being accommodated to the Mines of *Mendip* in *Somerſet-ſhire*, where the following Obſervations were made; *viz.*

To the 1, 2, 3 *Queries*. That all *Mendip* is Mountanous, yet the Hills not equal in height. That it is barren and cold, and rocky in ſome places. That the Ridges thereof run confuſedly, but moſt *Eaſt* and *Weſt*, and not in any *Parallel* one with another. That upon the *Surface* thereof it is Heathy, Ferny and Furzy; and the Cattle, it feeds, for the moſt part are Sheep, which go there all the year; and young Beaſts, Horſes and Colts at Spring and Fall. That the Sheep are not faire, but big-bellyed, and will grow to no bigneſs, after they have been there fed; but will grow fat, if they are removed into better ſoyle, and ſo their Beaſts and Horſes.

To the 4, 5, 6, 7 *Queries*. That the Natives and Inhabitants

live neither longer or ſhorter, than ordinary, but live healthy, ſaving ſuch, as are employed about melting of the Lead at the Mines; who, if they work in the ſmoak, are ſubject to a Diſeaſe, that will kill them, and the Cattel likewiſe that feed thereabout. The Smoak, that reſts upon the ground, will bane them. And therefore the Inhabitants have keepers to keep them from it, for fear of the Infection. That the Country is not furniſht with many Rivers, and Waters, that riſe upon the Hills: But from the bottom of the hills there are many Springs round about, both to the *North*, *South* and *Weſt*; and thoſe Waters are very wholeſome, and produce Rivers, after they have run to ſome diſtance from thence. That the *Air* is moiſt, cold, foggy, thick, and heavy. That it is obſerved often covered with miſts and fogs; and if any Rain be in the Country thereabout, it is ſurely there; and 'tis probable, it may ariſe from the Mineral and Subterraneous Steams. That the *Soyle* near the ſurface of the Earth is red and ſtony; and the ſtones that are drawn out thence, are either of the nature of *Fire-ſtones*, or *Lime-ſtones*, but no way *Clays*, *Marly* or *Chalky*.

To the 10, 11, 12, 13, 14, 15 *Queries*. That the *Trees*, growing thereon, have their tops burnt, and their leaves and out-ſides diſcoloured, and ſcorched with the Wind, and grow to no bigneſs or ſtature. That the *Stones* and Pebles, that are waſhed with the Brooks and Springs, are of a *reddiſh* colour, and ponderous. That *Snow*, *Froſt* and *Dew* ſtay upon *Mendip* longer, then upon any of the neighbouring grounds; but whether the *Dew*, falling upon the ground, will diſcolour Linnen, *I* have not obſerv'd.

To the 16, 17, 18, 19, *Queries*. That *Mendip* is more than ordinary ſubject to Thunder and Lightning, Storms, Nocturnal Lights and fiery *Meteors*. That the Miſts ariſe out of the *Vales*; but whether they ſignifie, where the Minerals are, *I* cannot ſay. That the *Virgula divinatoria* hath not been known to have been ſeen uſed in theſe parts. That there are no *certain* ſignes above ground, that afford any probability of a Mine, to my knowledge.

To the *Querie* in the *fifth* Title, *I* can ſay little, ſave only, That the Ore upon *Mendip* lies in Veines as a Wall; in ſome places

places deeper, in some shallower; in some places narrower, in some broader; but lies altogether, and is *perfect Lead*, only in the Outside, covered with *reddish* Earth.

To the *Queries* in the *sixth* Title, *I* cannot say much; it must be resolv'd by them, that melt the Lead-Ore, with which *I* have not been much acquainted, save only, that they beat the *Ore* small; then wash it clean in a running stream; then sift it in Iron-Rudders; then they make of Clay or Fire-stone a Hearth or Furnace, which they set in the ground, and upon it build their Fire, which is lighted with Char-coal, and continued with young Oaken-gadds, blown with Bellows by Mens treading on them: And after the Fire is lighted, and the fire-place hot, they throw their Lead-Ore upon the Wood, which melts down into the Furnace; and then with an Iron-Ladle they take it out, and upon sand cast it into what forme they please.

So far this Account, which is hoped will be made in time more compleat, and succeeded with the like *Answers* from other places.

An Extract

Of a Letter, *sent from* Paris, *about the* Load-stone; *where chiefly the suggestion of* Gilbert *touching the Circumvolution of a* Globous *Magnet, call'd* Terrella; *and the* Variation *of the* Variation, *is examined.*

This Letter *was written by the Intelligent and Experienced Monsieur* Petit, *Intendant of the Fortifications of his* Most Christian Majesty, *to the* Publisher, *as followes*;

I Have received yours, wherein you desire to know my sentiment about the *present Variation* of the *Needle*, intimating withal, that an Artist in *London* affirms, that whereas heretofore the Declination was *East-ward*, 'tis now about *one degree* and *a half* to the *West*.

Nothing can be more welcome to me, than to have occasion given me to discourse of this Subject, especially to the Philosophers of *England*, whence the Philosophy of the *Magnet*

had its rise, and whence also the Principal Observations of the *Change* of its Declination are come to us; so that 'tis just that the Observations, made elsewhere concerning the same, should return thither, as to its source.

I shall therefore let you know, that having always been Curious in the Doctrine of the *Load-Stone*, after *I* had made the Experiments, that are in *Gilbertus* and others, *I* made that of the Needles *Declination* on three different Meridian-Lines, which *I* traced *An.* 1630. in several places of *Paris*, and found, that the Needle declined 4½ degr. *North east*: which having publisht, and made known here to the Curious and to Artists, *some* of whom counted 9 or 10 degrees according to the Tradition and Writings of *Orontius Fineus*, and *Castelfranc*; others, 11½ *degrees*, following *Sennertus* and *Offusius*: all at first rejected my Observation; and as commonly New things meet with obstacles and contradictions, before they are establisht, those that could not contradict what they saw, pretended, that this Variety did perhaps proceed from the greater or lesser vigour in the Loadstones, employed to touch with; or from thence, that the Needles had been touch't nearer *to* or farther *from* their *Poles*; which might make them decline more or less from the *Meridian*, so as a Needle, being precisely toucht by the *Pole* of a good *Magnet*, might perhaps have no *Declination* at all.

All which conjectures were not without their probability; which was the greater, in regard that all the *Loadstones I* had seen, being rude and like Flints, with irregular surfaces, in bunches and cavities, their *Poles* were always ill posited, and often *within* some of the Cavities, so that one could not be sure to strike the *Needle* thorow the *Pole* of the Stone. To remove which difficulty, and at the same time to find another quality (one of the excellentest of the World, if true;) *viz.* that which *Gilbert* had assigned to *Terrella*'s; *I* resolv'd, to make the Experiment of it. And because *I* have not yet written of it, nor any man, *I* know, (Men having contented themselves with refuting this Error by Discourse only) you will perhaps not be displeased to be inform'd of the success thereof.

You

You know, that *Gilbert*, though the first, that has writ rationally of the *Magnet*, and began to say no follies of it, writes about the end of his *Book* (yet *without* being *positive*) that if a *Magnet* altogether round were placed on a *Meridian*, and its *Poles* so posited, as to answer to the Poles of the World, and consequently its *Axis* to the *Axis* of the World, the Stone would continually of its self turn round in 24 hours. Whence he inferrs, that the whole *Earth*, as a great *Magnet*, turns also round about its *Axis* in the same space of time.

To explore the truth of this *Proposition* (which I wish were true; since *then* we should have a perpetual motion without wheels, and a Watch yet juster than *Pendulums*) I found the means of causing two *Magnets* to be turn'd with the *powder* of *Emery*; the one whereof having been made *Spherical* with all possible exactness, became very solid, plain, and without any visible pores, or diversity of matter, being $1\frac{1}{2}$ inch in *diameter*: the other, bigger, of $3\frac{1}{2}$ inches *diameter*. but of less vigour, porous also and uneven; which made me lay it aside as useless for this Experiment, because, though it had been perfectly *spherical*, as the lesser, *I* could not be assured, that its *Center* of *Magnitude* was the same with those of its *Gravity*, and *Strength*; which was requisite to make good *Gilbert*s Proposition.

But for the other smaller *Magnet*, that had no defect, and its three Centers were the same, with so much justness, that after *I* had exactly found the two Poles of this Stone, *I* caused two small holes to be made therein, to support it by two points of Needles, as by two *pivots*: which having put in a Meridian of Brass, and suspended the Ball betwixt them like a little Globe, it was so easily moveable, that *I* made it turn every way with a blast only of my mouth, and it stopp'd indifferently, now in one, then in another place, not any side of it prevailing by its gravity, nor descending, as it would have done, if any of them had been heavier than another.

This *Stone* thus prepared without any defect in virtue or figure, uniforme, homogeneous, equilibrated, being adjusted on its *Meridian* and a *Horizon*, so placed on its Meridian-line, that the *Poles* thereof answer'd to the *Poles* of the Heavens (as hath been said already;) the success was, that it had not any *Motion*,

and a ſmall white mark, *I* had made upon this *Stone*, remained ſtill in the ſame place, where *I* had put it, without turning at all: whence *I* thought the Propoſition of *Gilbert* ſufficiently refuted.

This *Stone*, having ſerv'd me for this Experiment, did, together with the greater *Stone*, (whereof the *Poles* were alſo well marked) ſerve me alſo to find out, whether the Needles, touched in different places, nearer to, or further from the *Poles*, had *different* Declinations. Which having tryed frequently with theſe, and with other Stones, *I* found no difference at all in the *Declination* of the *Needles*.

And now to return to the main ſubject of the Letter, *I* then obſerv'd, that all theſe *Needles* declined *then* from the *Meridian* $4\frac{1}{2}$ degrees from the *North* Eaſtward. And, as *I* did not ſuſpect, that this declination would have changed, having found it to be the ſame in many places, from *Breſt* in *Brittany* to the *Valtoline* among the *Alpes*, *I* believed, the *Antients* had ill obſerv'd, and that the want of their exactneſs, in reſpect either of the *Meridian-line*, or the fabrick of their *Needles*, or the diviſion of their *Circles*, was the cauſe of this defect. But *I* was ſoon undeceived of my own Error, when *I* learned a little while after, by Letters from *England*, that Mr. *Burrows*, *Anno* 1580. had near *London* obſerv'd the declination of the Needle to be 11. degr. 11. min. as well as *Offuſius* and *Sennertus*: And that *Anno* 1612. Mr. *Gunther*, Profeſſor of the Mathematicks, had in the ſame place found that *Declination* much diminiſht, having then found but *6 degrees*: And *laſtly*, that *Anno* 1633. Mr. *Gellibrand* had found it but 4. degrees *North-eaſt*, conformable to my Obſervations. Which did aſſure me, that thoſe *Declinations* were not conſtant, but had varied.

And that *I* might be convinced by my ſelf, I made from time to time Experiments in divers places, and found ſtill more and more diminution; ſo that *Anno* 1660. in *June*, after *I* had very exactly traced a *Meridian* by many *Azimuths*, before and after noon, with a Braſs-Quadrant of 6. foot *diameter*, and applyed good Needles upon it, the one of 7. the other of 10. *inches* long, *I* found that they declined but *one* degree, or thereabout: And

the

the laſt year * *I* found no more but 10. minutes on the ſame *Meridian*. Upon which having lately applied, ſince the receipt of the Letter, the ſame two *Needles*, me thinks, the *Declination* is yet leſs, than the laſt year. But this I can aſſure you, that the *Declination* is yet ſome *minutes* towards the *Eaſt*, at leaſt at *Paris*. So that you may, upon my word, doubt * of the Obſervation of your friend, whom perhaps the *Meridian*, or the *Needle*, or the Conſtruction and Diviſion of his Compaſs may have deceived, to a *degree* and a *half* North-weſt, which he at the preſent aſſignes to the *Declination*. But I doubt not, but in 12 or 15 years it will be found true what he affirms, as I have prognoſticated by my *Hypotheſis*, which maketh the *Declination* to vary a degree every *ſeven* or *eight* years.

* This Letter was written this preſent year.

* By the favour of the *Author*, it is not concluſive, that becauſe the Declination is yet ſomewhat towards the *Eaſt* at *Paris*, that therefore it muſt be ſo at *London*: Since 'tis known here, that even the *Variation* of *White-hall* differs from that of *Lime-houſe*; which two places are but 4. *Engliſh* miles, or thereabout, diſtant from one another.

This is, what I had to return to the Letter, which I wiſh might deſerve to be preſented to your *Illuſtrious Society*, and contribute ſomething to the diſcovery of ſo many admirable vertues lodged in this Stone, and principally to the finding out of the *Cauſe* of this *Variation*; for which I have already made ſome attempt, and propoſed my thoughts in a *Diſſertation de Latitudine Pareſienſi & Magnetis Declinatione*, which *M. du Hamel* cauſed to be printed *Anno* 1660. with his *Aſtronomia Phyſica*. I ſhall be very glad, to learn the ſentiment of your Learned Philoſophers thereupon, and what cauſe they ſuſpect there is of ſo ſingular an effect. I could diſcourſe to you of other particulars touching the Proprieties of the *Load-ſtone*, and eſpecially of a remarkable one, I have diſcover'd, and which, if I am not deceived, ſubverts that *Theory*, which undertakes to explicate all theſe effects by the *Particulæ ſtriatæ*; but I reſerve that for another occaſion.

Ann

An Account of ſome Books.

I. FREE CONSIDERATIONS *about* SUBORDINATE FORMS; *by the Honourable* ROBERT BOYLE

THis Tract is an *Appendix* to the Noble Author's *Examen of Subſtantial Forms*, publiſhed laſt year, and reprinted this. There hath been already given an Account of the principal Part, as appears by *Numb.* 11. 'Tis very fit the like ſhould be done now of this conſiderable *Appendix*.

Firſt then it clears up and ſtates the Doctrine about *Subordinate Forms*, as it is maintain'd by divers learned *Moderns*, eſpecially *Sennertus*, who teacheth, that beſide the *Specifick Form* (ſo called by him) there may reſide in Animals and Plants, certain other Forms, ſo ſubject to the predominant *Miſtreſs-Form*, that they deſerve the Title but of *Subordinate* Forms, and during the Reign of the *Specifick*, are ſubſervient to it; yet when *that* is depoſed or aboliſht, theſe *Inferiour* Forms may come to ſet up for themſelves, *viz.*

This done, the Author tryes, Whether the *Phænomena* and Effects of theſe pretended *Subordinate Forms* may not be as well as the principal ones, intelligibly explicated by the *Mechanical Principles*, *vid. Matter* and *Motion*, and the thence reſulting *Shape* and *Texture*. Which that it may be done, is ſo happily made out in this *Tract*, that a Rational, Unprejudiced and Attentive Reader cannot but embrace the *Author's* Doctrine, and, according to it, be ſatisfied, that the portions of Matter, that are endowed with theſe pretended *Subordinate Forms*, cannot pay the preſumed *Superintendent Form* any other obedience, then ſome ſuch kind of one, as the parts of a *Clock* or *Engine* may be ſaid to yield to one another. So that the whole matter may be well conceived to be nothing but this; That, when divers bodies of differing natures or *Schematiſmes* come to be aſſociated ſo as to compoſe a Body of one denomination, though each of them be ſuppoſed to act according to its own peculiar nature, yet by reaſon of the coaptation of thoſe parts, and the contrivement of the compounded Body, it will many times happen, that the action

action or effect produced, will be of a *mixed* nature, and differing from that, which ſeveral of the parts conſider'd as *diſtinct* Bodies or Agents, tended to, or would have perform'd ; As when in a Ballance, by putting in a weight into one of the Scales, the oppoſite Scale, though as a heavy body, it will naturally tend downwards, yet by virtue of the fabrick of the *Inſtrument* is made to mount upwards. So that thoſe Actions, which Scholaſtical men attribute to the conſpiring of ſubordinate *Forms* to aſſiſt the *Specifick*, are but the reſultant actions of ſeveral Bodies, which being aſſociated together, are thereby reduced in many caſes to act jointly, and mutually modifie each others actions ; and that which they aſcribe to the dominion of the *Preſiding* Form, is to be imputed to the ſtructure and connexion of the parts of the compounded Body.

This the Author confirms and illuſtrates by many very inſtructive Examples and Compariſons, taken from manual Arts and Practiſes, Phyſicks, Chymiſtry, &c. And applying his doctrine about theſe *ſubordinate Forms* to inanimate Bodies, he ſums up the heads of all, and caſts them into 9 diſtinct Propoſitions, which are ;

1. The word *Form* is of an indeterminate ſignification.

2. 'Tis not eaſie, to decide the *Nobleneſs* of Forms.

3. In divers Bodies the Form is attributed upon the account of ſome eminent *Property* or *Uſe* ; which if it be preſent and continue, though many other things ſupervene, or chance to be wanting, the matter is nevertheleſs lookt upon, as retaining its Form, and is wont to be allow'd its uſual denomination.

4. By reaſon of the Conjunction or Connexion of the *parts*, that make up a *whole* (or, at leaſt an Aggregat of Bodies, that for their connexion are looked upon as ſuch) it will often happen, that ſeveral things will be perform'd by the joint or concurrent Action of theſe united or coherent parts.

5. We may yet in a *ſound ſenſe* admit, that in ſome Bodies there may be *ſubordinate Forms*.

6. The ſupervening of a new Form is often but accidental to the Pre-exiſtent Form, and (*then*) does not at all deſtroy its nature, but modifie its operations.

7. Beſides the *Specifick* actions of a Body, that harbours *ſubordinate Forms*, there may be divers others, wherein ſome of the

Parts or Ingredients may act according to their particular and priſtine nature.

8. In divers Bodies, that which is call'd or look'd upon as the *Specifick* Form, is often not ſo much as the *Preſiding*, but only the *moſt eminent*.

9. The Forms diſcourſed of, ſeem to be rather *concurrent*, than *ſubordinate*.

To each of theſe *Propoſitions* are annexed ſhort *Comments*, full of very pertinent and teaching Inſtances, Relations, Compariſons, &c. for which the *Reader* is referred to the Book it ſelf.

II. *Joh. SWAMMERDAM, M.D. Amſterodamenſis de RESPIRATIONE & VSV PVLMONVM.*

THis *Author* is of opinion, that all thoſe Philoſophers, who have hitherto inquired into the *Nature* and *Uſe* of *Reſpiration*, have only caught the ſhadow of it, nothing of the ſubſtance. And of this he gives this for the chief reaſon, becauſe they have been too negligent in conſidering the firſt manifeſt motion of the Breaſt and Lungs in a *Fœtus*; which particular being underſtood, he thinks it very eaſie to judge of the Reſpiration of *born* Animals. He ſcruples not to reprehend the immortal Doctor *Harvey*, for having excluded from the office of the Lungs the Vſe of *Refrigeration*; which he pretends to have aſſerted himſelf by moſt evident Experiments, and uncontrolable Reaſons.

To repreſent diſtinctly, what he undertakes to make out in this *Tract*, we may take notice of theſe particulars:

1. He takes pains to refute the Doctrine of *Attraction*, and to ſubſtitute in its place the Doctrine of *Pulſion* or *Intruſion* of Air into the Lungs.

2. He endeavours to aſſert, that the Lungs do not *fall down*, but are by the Breſt *contracted*.

3. He affirms, to have clearly ſhew'd, what is the proper function and work of the *Diaphragme*, and other *Muſcles* ſerving for Reſpiration.

4. He pretends, to have experimentally evinced the Genuine *Uſe* of *Reſpiration*, and the Benefit thence reſulting to the Animal Life.

In

In *ſhort*, He makes *Reſpiration* to be a Motion of the Thorax and Lungs, whereby the Air is ſometimes impelled by the Noſe, Mouth and Wind-pipe into the Lungs; and thence again expelled; farther to elaborate the Bloud, by *Refrigerating it*, and by Separating its *fuliginous ſteams*, and ſo raiſe it to its ultimate and higheſt perfection, for the Conſervation of the Life of Animals.

Notice may be taken here by the by, that this *Author* in his *Preface* promiſes the publiſhing of a *Treatiſe* about *Inſects*; in which he engages to ſhew many wonderful things in thoſe little and ſeemingly contemptible Creatures, and in particular to demonſtrate to the Eye the very method and manner how a *Caterpillar* is tranſmuted into a *Chryſalis* or *Aurelia*: By performing of which, he hopeth, he ſhall make the *Curious* bear more eaſily the loſs of Dr. *Harvey*'s Treatiſe on that Subject.

III. *Obſervations faites ſur vn* GRAND POISON, *& vn* LION, *diſſequés dans la Bibliotheque du Roy à* Paris, *le* 24. *& le* 28. *Juin*, 1667.

THis *Great Fiſh*, diſſected by the *Pariſian* Philoſophers, was a *Vulpecula Marina* (a Sea-fox:) in which they obſerve'd;

Firſt, The length of his Tail, equalling very near the whole length of the reſt of his body, (the whole Fiſh being 8½ feet long) and faſhioned after the manner of a Sithe, bowed and turned up toward the belly.

Secondly, His *Mouth* was armed with two ſorts of Teeth; one ſort in the upper Jaw, being pointed, hard and firme, and of one only bone, in the manner of a *Saw*: the other ſort, found in the reſt of the upper, and in the whole under-Jaw, were moveable, and faſtned by fleſhy membranes.

Thirdly, His *Tongue* did altogether adhere to the lower Jaw, and its skin was hard and covered with little ſhining points, which rendred it very rough and ſcabrous one way. The points viewed with a Microſcope, appeared tranſparent like Chryſtal.

Fourthly, His *Throat* was very large, and the *Oeſophagus*, as large as his Maw; concerning which Authors ſay, that he hath the dexterity of diſengaging himſelf from the ſwallowed hook, by caſting it up together with his *Maw*, the inſide of it turned out. They

found in his *Maw* the Sea-herb, *Varec*, 5. inches long, and a *Fiſh* of the like length without head, ſcales, skin and guts, all being waſted but the muſculous fleſh, which remained entire.

Fifthly, The ſuperiour part of his *great Gut* had this peculiar, that inſtead of the uſual circumvolutions of Guts, the cavity of this was divided tranſverſly by many partitions, conſiſting of the membranes of the *Gut* turned inwards, and in the figure of a Vice, like Snail-ſhels, or winding Stairs.

Sixthly, His *Spleen* was double; his *Liver* divided into two Lobes; the *Gall* found to have more of bitter than ſower: the *Heart*, without a *Pericardium*, as big as a Hens egge; the *Head* almoſt nothing but a maſs of Fleſh, very little Brains in it, and that which was there, having very few meanders or windings: the *Eyes*, bigger than thoſe of an *Oxe*, only half-ſpherical, flat before; the *Sclerotica* formed like a Cup, very thin, but very hard; the *Cornea* very tender and ſoft; the *Chryſtallin* perfectly ſpherical; the *Vuea* grayiſh; the *Choroides* of the ſame colour, and pierced, for the production of the *Retina*, by a very large hole: the bottom of this *Choroides* had that luſtre of Mother of Pearl, which is found in *Terreſtrial* Animals, but with leſs vivid colours: and the *Retina* was alſo ſtreaked with very apparent ſanguineous Veſſels.

The Obſervables in the *Lyon* were,

In *general*, that for outward ſhape, and the conſtitution of many parts, as the *Claws*, *Teeth*, *Eyes*, *Tongue*, (beſides the likeneſs of the *Viſcera*) a *Lyon* reſembles very much a *Cat*.

In *particular*, an admirable ſtructure of his *Claws*; a peculiar ſhape and poſition of his *Teeth*; a very ſtiffe *Neck*; a mighty rough and ſharp *Tongue*, having points like claws both for hardneſs and ſhape. *Eyes* very clear and bright, even after death, which without cloſing the Eye-lids, Lyons can cover with a thick and blackiſh membrane, placed towards the great Angle, which by raiſing it ſelf and reaching towards the ſmall Angle, can extend it ſelf over the whole *Cornea*, as tis in *Birds*, but eſpecially in *Catts*: The reverſe of the auterior *Uvea*, where it lyes over the *Chryſtallin*, is altogether black: the *Chryſtallin* very flat, and its greateſt convexity, which is not uſual, in its anterior part, as tis in *Cats*: the *Aqueus* humour very plentifull, equalling almoſt the ſixt part of the *Vitreous*, which plenty was judged to be the cauſe of the brightneſs, that remains in the eyes after death.

His

His *Throat* was not above an Inch and a half large: the *Stomach*, 6 inches large, and 18 inches long: all the *Guts* 25 foot long: the *Liver*, divided into 7 *Lobes*, as in Cats; its cavity under the *Bladder of Gall* was full of Gall, ſhed abroad in the ſubſtance of the *Liver*, and of the neighbouring parts; which was ſuſpected by the Phyſitians, adminiſtring this operation, to have been the cauſe of this *Lyons* death: the *Bladder of Gall* was 7 inches long, and $1\frac{1}{2}$ inch large, of a peculiar ſtructure: the *Spleen*, a foot long, 2 inches large, and $\frac{1}{2}$ inch thick: the Kidney weighed ſomewhat above 7 ounces: the *Genitals* of a peculiar conformation, cauſing this Animal to caſt his Urine backwards, and to couple like *Camels* and *Hares*.

His *Lungs* had 6 *Lobes* on the right ſide, and 3 on the left: the *Wind-pipe* had its annular Cartilages *entire*, excepting two or three; it was above four inches in compaſs, being very firme, and by this bigneſs and firmneſs enabling a Lyon, ſtrongly to thruſt Air enough through it, for his dreadful *roaring*.

His *Heart* was dry, and without water in the *Pericard*; much greater in proportion, than of any other Animal, being ſix inches long, and four inches large towards the *baſis*, and terminating in a ſharp point. It had very *little* fleſh, and was all hollow; the Ventricles very large; the Auricles very ſmall: the proportion of the branches, which the aſcending *Aorta* caſts out, was ſuch, that the *Carotids* were as big, as the left *Subclavial* branch, and as the reſt of the right *Subclavial*, whence they iſſue; Which is conſiderable, ſeeing the *Brain* is ſo ſmall: For the *Brain* was but two inches big, of any dimenſion; the reſt of the head being very fleſhy, and conſiſting of very firm *Bones*. By comparing the little quantity of the Lyons *Brain* with the plenty of that of a *Calf*, it was Judged, that the having but little Brain is rather a mark and a cauſe of a fierce and cruel temper, than want of wit. Which conjecture was ſtrengthned by the obſervation formerly made in the *Sea-Fox*, in whom almoſt no Brains was found, though it be thought, that his craft and addreſs hath occaſioned men to give him that Name.

IV. HISTORIA AMBRÆ, *Authore* JUSTO KLOBIO, D. *in Academ. Wittebergenſi.*

THis Author reckons up 18 Opinions concerning *Ambergriſe*, and having examined every one of them, he embraces that, which holds, That it is the *Dung* of a *Bird*, (called in the *Madagaſcar* Tongue, *Aſchibobuch:*) of which he gives the deſcription out of *Odoardus Barboſa* and others; who affirm it to be of the bigneſs of a Gooſe, curiouſly feather'd, with a big head, well tufted. Theſe Birds being found in great numbers in *Madagaſcar*, the *Maldiues*, and other parts of the *Eaſt Indies*, are affirmed by *Authors* to flock together in great numbers, as Cranes; and frequenting high Cliffs near the Sea-ſide, and there voiding their Excrement, the Sea waſhes it thence, if it fall not of its ſelf into it.

There is another opinion among the ſaid 18, for which the *Author* hath a good inclination, but yet dares not embrace it; *viz.* that 'tis the *Excrement* of a certain kind of *Whales*. If this *Amber* were but in thoſe other places, where there is good ſtore of ſuch *Whales*, it ſeems that would make the *Author* relinquiſh the former Opinion.

This puts us in mind of a *Relation*, to be met with in *Purchas*, which, giving an Account of a certain Commiſſion for a Gentleman to go Factor into *Greenland* for the killing of *Whales* and *Morſes*, takes notice, among other Particulars, of a ſort of Whales, called *Trompa*, having but one Trunk on his head, whereas the *Sarda*, another kind of Whales, hath two. This *Trompa*, (ſaith that Author) hath teeth of a ſpan long, and as thick as a mans Wriſt, but no Finns. In his *Head* is the *Sperma Ceti*, ſaith he farther, and in his *Entrails*, the *Amber-greeſe*, being in ſhape and colour like *Cowes-dung*. Expreſs order was given in the ſaid Commiſſion, that the perſon deputed ſhould himſelf be preſent at the opening of this ſort of Whale, and cauſe the reſidue of the ſaid Entrails to be put in ſmall Casks, and bring them along with him into *England*.

This will give occaſion to increaſe our *Inquiries* for *Greenland*; which perhaps may be inſerted in the *Book* of the next Month.

An

An Account
*Of an Experiment made by M.*Hook, *of Preſerving Animals alive by Blowing through their Lungs with Bellows.*

This Noble Experiment came not to the Publiſher's *hands, till all the preceding Particulars were already ſent to the Preſs, and almoſt all Printed off, (for which cauſe alſo it could not be mentioned among the* Contents:) *And it might have been reſerved for the next opportunity, had not the conſiderableneſs thereof been a motive to haſten its Publication. It ſhall be here annexed in the Ingenious* Author *his own words, as he preſented it to the* Royal Society, Octob. 24. 1667. *the Experiment it ſelf having been* both *repeated (after a former ſucceſsful trial of it, made by the ſame hand a good while agoe)* and *improved the week before, at their* publick Aſſembly. *The Relation it ſelf followes*;

I Did heretofore give this *Illuſtrious Society* an account of an Experiment I formerly tryed of keeping a Dog alive after his *Thorax* was all diſplay'd by the cutting away of the *Ribbs* and *Diaphragme*; and after the *Pericardium* of the Heart alſo was taken off. But divers perſons ſeeming to doubt of the certainty of the Experiment (by reaſon that ſome Tryals of this matter, made by ſome other hands, failed of ſucceſs) I caus'd at the laſt Meeting the ſame Experiment to be ſhewn in the preſence of this *Noble Company*, and that with the ſame ſucceſs, as it had been made by me at firſt; the Dog being kept alive by the Reciprocal blowing up of his Lungs with *Bellowes*, and they ſuffered to ſubſide, for the ſpace of an hour or more, after his *Thorax* had been ſo diſplay'd, and his *Aſpera arteria* cut off juſt below the *Epiglottis*, and bound on upon the noſe of the Bellows.

And becauſe ſome Eminent Phyſitians had affirm'd, that the *Motion of the Lungs* was neceſſary to Life upon the account of promoting the Circulation of the Blood, and that it was conceiv'd, the Animal would immediately be ſuffocated as ſoon as the Lungs ſhould ceaſe to be moved, I did (the better to fortifie my own *Hypotheſis* of this matter, and to be the better able to judge of ſeveral others) make the following additional Experiment; *viz.*

The Dog having been kept alive, (as I have now mentioned) for above an houre, in which time the Tryal had been often repeated, in ſuffering the Dog to fall into *Convulſive* motions by ceaſing to blow the Bellows, and permitting the Lungs to ſubſide and lye ſtill, and of ſuddenly reviving him again by renewing the blaſt, and conſequently the motion of the Lungs: This, I ſay, having been done, and the Judicious Spectators fully ſatisfied of the reallity of the former Experiment; I cauſed another pair of Bellowes to be immediately joyn'd to the firſt, by a contrivance, I had prepar'd, and pricking all the outer-coat of the Lungs with the ſlender point of a very ſharp pen-knife, this ſecond

pair

pair of Bellows was mov'd very quick, whereby the firſt pair was alwayes kept full and alwayes blowing into the Lungs; by which means the Lungs alſo were alwayes kept very full, and without any motion; there being a continual blaſt of Air forc'd into the Lungs by the firſt pair of Bellows, ſupplying it as faſt, as it could find its way quite through the Coat of the Lungs by the ſmall holes pricked in it, as was ſaid before. This being continued for a pretty while, the Dog, as I exſpected, lay ſtill, as before, his eyes being all the time very quick, and his Heart beating very regularly: But, upon ceaſing this blaſt, and ſuffering the Lungs to fall and lye ſtill, the Dogg would immediately fall into Dying convulſive fits; but be as ſoon reviv'd again by the renewing the fulneſs of his Lungs with the conſtant blaſt of freſh Air.

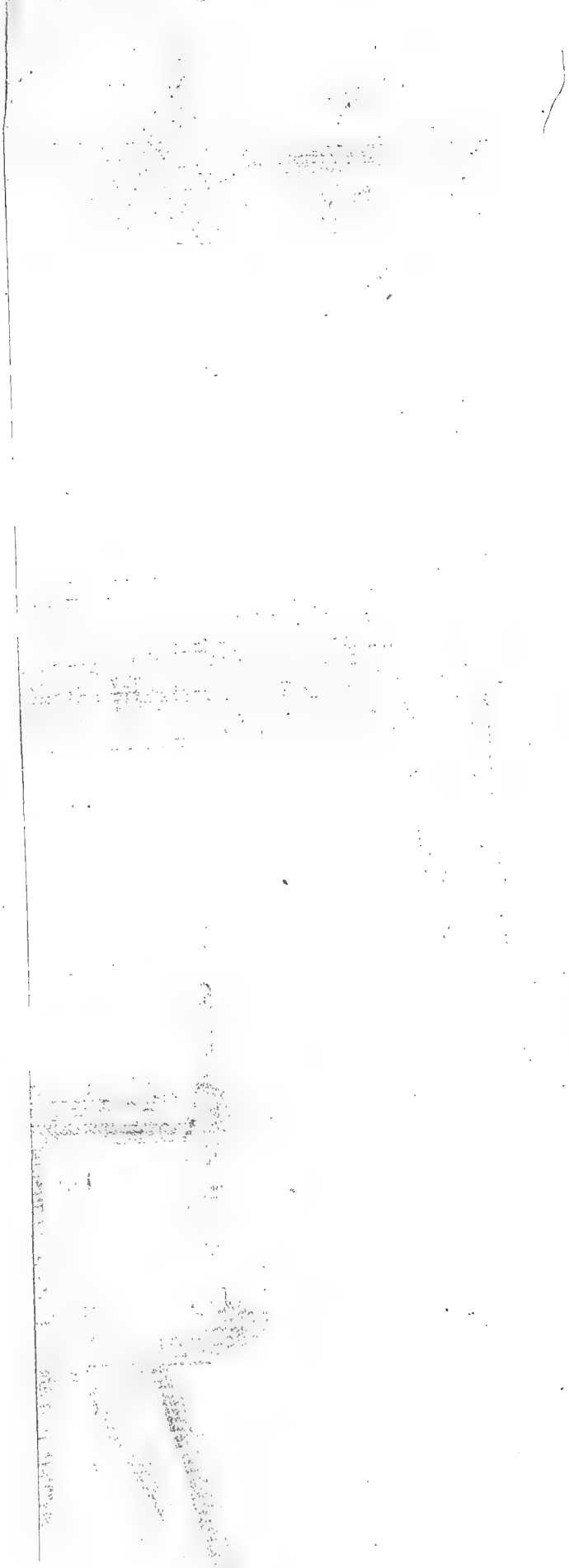
Towards the latter end of this Experiment a piece of the Lungs was cut quite off; where 'twas obſervable, that the Blood did freely circulate, and paſs thorow the Lungs, not only when the Lungs were kept thus conſtantly extended, but alſo when they were ſuffer'd to ſubſide and lye ſtill. Which ſeem to be Arguments, that as the *bare* Motion of the Lungs *without freſh Air* contributes nothing to the life of the Animal, he being found to ſurvive as well, when they were not mov'd, as when they were; ſo it was not the ſubſiding or moveleſneſs of the Lungs, that was the immediate cauſe of Death, or the ſtopping the Circulation of the Blood through the Lungs, but the *want* of a ſufficient *ſupply of freſh Air*.

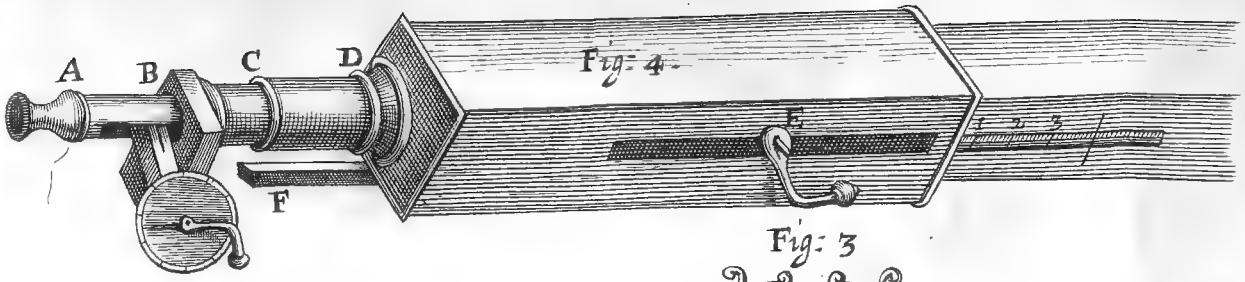
I ſhall ſhortly further try, whether the ſuffering the Blood to circulate through a veſſel, ſo as it may be openly expoſed to the freſh Air, will not ſuffice for the life of an Animal; and make ſome other Experiments, which, I hope, will throughly diſcover the *Genuine uſe of Reſpiration*; and afterwards conſider of what benefit this may be to Mankinde.

FINIS.

In the *SAVOY*,

Printed by *T. N.* for *John Martyn*, at the Bell a little without *Temple-Bar*, and *Nathaniel Brooks* at the Angel in *Greſham-Colledge*, 1667.





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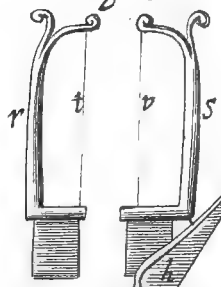


Fig: 3

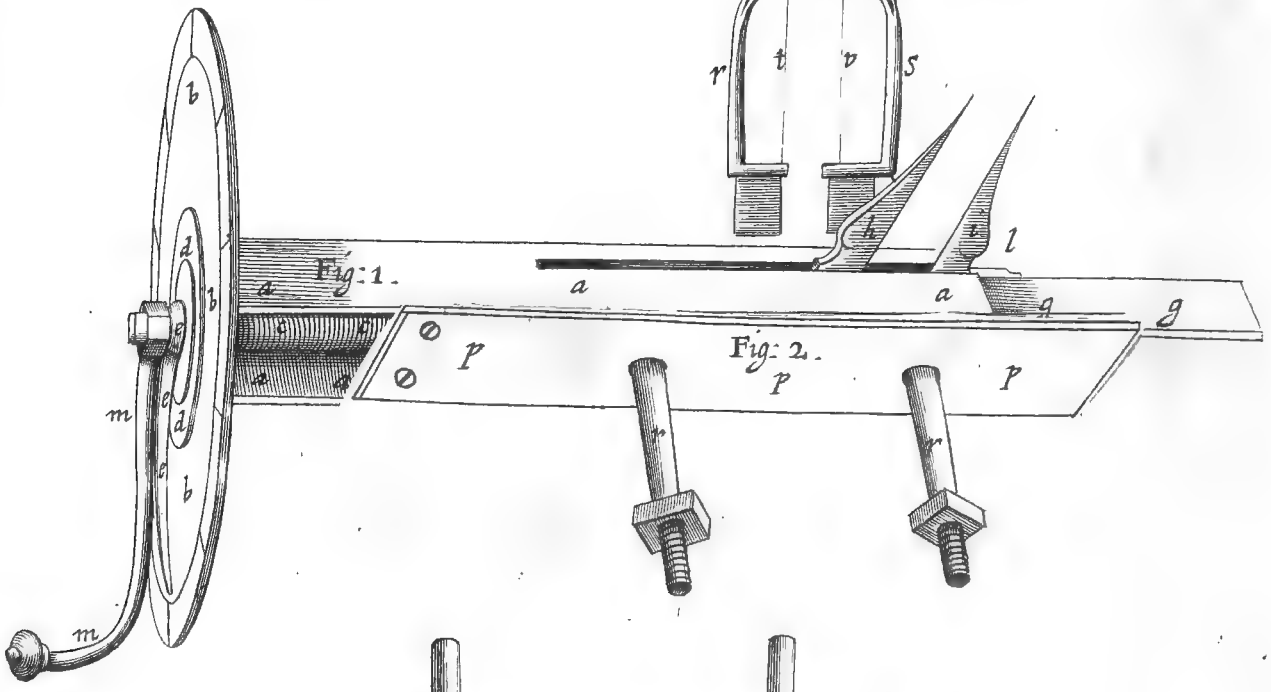


Fig: 1.

Fig: 2.

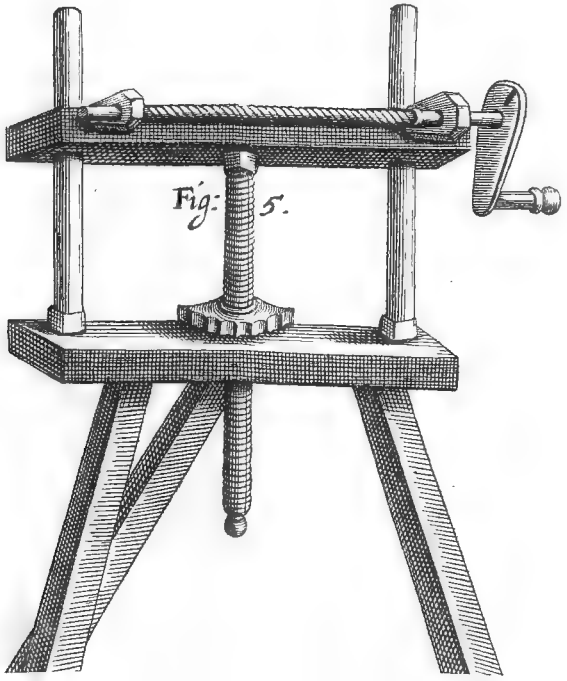
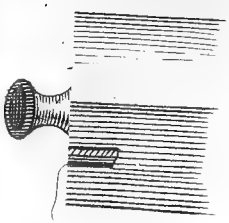
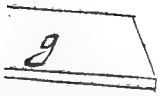


Fig: 5.

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PHILOSOPHICAL TRANSACTIONS.

Monday, *Novemb.* 11. 1667.

The Contents.

A deſcription of an Inſtrument *for* Dividing a Foot into many thouſand parts, *and thereby* meaſuring the Diameters of Planets *to great exactneſs*, &c. *as it was formerly promiſed. An account of making a Dog draw his Breath juſt like a* Wind-broken-*Horſe. Divers* Anatomical *Obſervations on* Humane *Bodies. Several Inſtances of* Peculiarities *of Nature, both in* Men *and* Brutes. *A Confirmation of the Experiments, mentioned in* Numb. 27. *to have been made in* Italy, *by Injecting* Acid Liquors *into* Bloud. *An Obſervation about the double Membrane call'd* Epiploon, *which covers the Entrals of Animals, and is fill'd with* Fatt. *Some* Hortulan *Communications, about the curious Engrafting of* Orenges *and* Lemons *or* Citrons *upon one anothers Trees, and of one* Individual *Fruit, half* Orenge *and half* Lemon, *growing on ſuch Trees. An intimation of a way of preſerving, in the more* Northern *Climats, Orenge-Trees all winter long, without any Fire. Inquiries for* Greenland, *An Account of the Synopſis* NOVÆ PHILOSOPHIÆ & MEDICINÆ *Franciſci Travagini*, Medici Veneti.

A Deſcription.

Of an Inſtrument *for* dividing a foot into many thouſand parts, *and thereby* Meaſuring the Diameters of Planets *to great exactneſs*, &c. *as it was promiſed*, Numb. 25.† † Fol. 457.

If the reſidence of the worthy Promiſer *of this* Inſtrument, *Mr.* Richard Townley, *had not been ſo remote from* London, *nor*

ſome other impediments intervened, (after it was come to hand,) Firſt on the Publiſher's, *then on the* Engraver's *ſide, the following Particulars concerning the ſame, promiſed ſome Moneths ago, had been imparted to the Publick a good while before this time. For the draught of the* Figures, *repreſenting the* New Inſtrument *it ſelf, and the Deſcription of the ſame, we are obliged to the ingenuity of Mr.* Hook.

THe 1. 2 and 3 *Figures*, do repreſent the ſeveral parts of this Inſtrument; the 4th *Figure*, part of the *Teleſcope* with the Inſtrument applied to it, and the 5th, the *Reſt*, on which the whole repoſeth.

The 1. *Figure* repreſents the *Braſs-boxe* with the whole *Inſtrument*, (excepting onely the *Moveable Cover.*) and the *Screws*, by which it is fixt to the *Teleſcope*. In this *Figure* (*a a a a*) is a ſmall oblong *Braſs-box*, ſerving both to contain the *Screws*, and its *Sockets* or *Femal Screws*, and alſo to make all the ſeveral moveable parts of the Inſtrument to move very true, ſmooth, and in a ſimple direct motion. To one end hereof is ſcrewed on a *Round plate* of Braſs (*bbbb*) about 3 inches over; the extream *Limb* of whoſe outſide is divided into a 100 *equal* parts, and numbred by 10. 20. 30. *&c.* Through the middle of this *Plate*, and the middle of the *Box* (*a a a*) is placed a very curiouſly wrought *Screw* of about the bigneſs of a Gooſe-quill, and of the length of the *Box*, the head of which is by a fixed *Ring* or *Shoulder*, on the Inſide, and a ſmall *ſpringing Plate*, (*d d*) on the Outſide, ſo adapted to the Plate, that it is not in the leaſt ſubject to ſhake. The other end of this *Screw* is by another *little Screw* (whoſe ſmall point fills the *Center* or hole made in the end of the *longer Screw*, for this purpoſe) rendred ſo fixt and ſteady in the *Boxe*, that there appears not the leaſt danger of ſhaking. Upon the *Head* of this *Screw* without the *Springing-Plate*, is put on a ſmall *Index* (*e e*) and above that a *Handle* (*m m*) to turn the *Screw* round, as often as there ſhall be occaſion, without at all endangering the diſplacing of the *Index*; it being put on very ſtiff upon a *Cylindrical* part of the *Head*, and the *Handle* upon a *Square*. The *Screw* hath that *Third* of it, which is next the *Plate*, bigger than the other

other *two Thirds* of it, by at leaſt as much as the depth of the *ſmall Screw*, made on it: The *thred* of the *Screw* of the bigger *Third* is as ſmall again, as that of the *Screw* of the other *two Thirds*. To the *greſſer Screw* is adapted a *Socket* (*f*) faſtned to a long *Barr* or *Bolt* (*gg*,) upon which is faſtned the *Moveable Sight* (*h*,) ſo that every turn of the *Screw* promotes the *Sight* (*h*) either a *thred* nearer, or a *thred* farther off from the *fixt Sight* (*i*) The *Barr* (*gg*) is made exactly equal and fitted into two ſmall *Staples* (*kk*) which will not admit of any ſhaking. There are 60 of theſe *threds*; and, anſwerable thereto, are made 60 *diviſions* on the edge of the *Bolt* or *Ruler* (*gg*;) and a ſmall *Index* (*l*) fixt to the *Boxe* (*aaa*) denotes, how many *threds* the *Edges* of the two *Sights* (*h*) and (*i*) are diſtant; and the *Index* (*ee*) ſhews on the *Circular Plate*, what part of a revolution there is more; every revolution, as was ſaid before, being divided into 100 parts. At the ſame time that the *moveable Sight* (*h*) is moved forwards or backwards, or more threds of the *Courſer Screw*, is the *Plate* (*pp. in Fig.* 2.) by the means of the *Socket* (*q*) to which it is ſcrew'd, moved forward or backward, or more *threds* of the *finer Screw*: So that this *Plate*, being fixt to the *Teleſcope* by the *Screws* (*rr.* in *Fig.* 2.) ſo as the middle betwixt the *Sights* may lye in the *Axis* of the *Glaſs*, however the *Screw* be turn'd, the midſt betwixt the *Sights* will always be in the *Axis*, and the *Sights* will equally either open from it, or ſhut towards it.

Figure 2. repreſents the *moveable Cover* containing the *Screws*, to be by the Bookſeller cut off, by the *pricked Line* (*xxx*) from the Paper, and to be fitly placed on *Figure* 1. according to the *pricked Line* (*yyy*) anſwering thereto; that by the taking off, as it were, or folding up of this *Cover*, the *inward* contrivance of the *Screws* and *Sights* may appear.

And becauſe it is conceived by ſome ingenious men, that it will be more convenient, inſtead of the Edges of the two *Sights* (*h* and *i*) to employ two *Sights* fitted with hairs, therefore is added *Figure* 3, repreſenting the two *Sights* (*r.* and *s.*) ſo fitted with *threds* (*t.* and *u.*) that they may be conveniently us'd in the place of the *ſolid Edges* of the *Sights* (*h.* and *i.*)

The 4th *Figure* repreſents, How the *Screws* are to be put on.

The *Tube* A D is divided into 3 lenghts; of which (as in ordinary ones) B C is to lengthen or contract, as the Object requires: But A B is here added, that at A. you may put ſuch *Eye-glaſſes* as ſhall be thought moſt convenient, and to ſet them ſtill at the diſtance, moſt proper for them, from the *Indexes* or *Pointers*, which here are ſupposd'd to be at B. which length alters alſo in reſpect of divers perſons Eyes. E. is a *Screw*, by which the *Great Tube* can be fixt ſo, as by the help of the figures, any ſmaller part of it can immediately be found, meaſuring only, or knowing the *diviſions* on B C, the diſtance of the *Object-glaſs* from the *Pointers*. F. is the *Angular* piece of wood, that lies on the *upper Screw* of the *Reſt*. This *Reſt* is repreſented by *Figure* 5.† As for a Deſcription of the *Uſes* of this ingeniouſly contrived and very curious *Engine*, the *Reader* is deſir'd to look back to the before alledged *Numb.* 25.†

† fol. 55 6 & 7 latter end.

† fol. 457.

An Account

Of making a Dogg *draw his Breath exactly like a* Wind-broken, Horſe *as it was deviſed and experimented by Dr.* Richard Lower; *with ſome of his* Inſtructive *Obſervations thereon.*

This Experiment was made before the R *Soc.* Octob. 17. 1667. *after it had been tryed by the* Author *in private, ſome while before. The Acccount of it in his own Words* ~~and~~ *follows.*

After I had often conſider'd the *manner* and way of *Reſpiration*, and by many Obſervations been induced to believe, that the *Diaphragme* is the *chief Organ* thereof, I thought, there could be no way more probable to try it, then by breaking the *Nerves*, by which its Motion is perform'd: Which may be eaſily (as it was actually) done after the following manner;

The chief organ of Reſpiration

Firſt, pierce the ſide of the Animal between the 6. and 7 Ribb in the middle of the *Thorax*, juſt over againſt the region of the Heart, with a ſmall *Inciſion-knife*, paſſing the knife but juſt into the Cavity of the Breaſt (which you may juſtly know by finding no reſiſtance to the point of it;) then take it out, and put in a *Director*, or a ſmall *Quill* made like it, and thruſt it in about *an Inch*, directing the end of it toward the *Sternum*, cloſe to the inſide of the Breaſt. Then cut upon it about an *inch* on the *Intercoſtal* Muſcles; by which you may be ſecur'd from touching the

Lungs

Lungs with the point or edge of your knife. This done, put in your finger, and with your nail ſeparate the *Nerve*, which paſſeth along the ſide of the *Pericardium* toward the *Diaphragme*. Then put in a *Probe*, a little inverted at the end like a hook, and apprehend the *Nerve*, and pull it to the Orifice of the Breaſt, and cut it off, and ſow the hole up very cloſe. Do the ſame on the other ſide, and preſently let the Dog looſe, and you will plainly ſee him draw his breath exactly like a *Wind-broken Horſe*: Which yet you will ſee plainer, if you run him a little in a ſtring after he is cut. But that any one may perform this Experiment the eaſier, let him firſt take notice, how the *Nerves* of the *Diaphragme* paſs along on each ſide of the *Pericardium* in a *dead* Animal, before the trial be attempted in a *Living* one.

The moſt obvious *Obſervations* from this Experiment, are:

1. That the whole *manner* of *Reſpiration* is quite alter'd. For, as in a *ſound* Animal, in *Inſpiration* the Belly ſwells by the lifting up the Bowels by the *Contraction* of the Diaphragme; and in *Exſpiration* the Belly falls by the *Relaxing* of the ſame: In a *wind-broken* Dog or Horſe 'tis quite contrary. For in them it is to be ſeen plainly, that when they draw their breath, their Belly is drawn in very lank and ſmall, and when they breath ~~up~~ out, their Belly is relaxt and ſwells again.

2. It being certain, that the *Lungs* do not move *of themſelves* at all, but wholly depend upon the *Expanſion* of the *Thorax* by the *Intercoſtal Muſcles*, and the *Diaphragme*; by this Experiment it doth appear, how much the *ſingle* motion of *either* of them doth *particularly* contribute to *Reſpiration*. For, all *Inſpiration* being made by the *Dilatation* of the *Thorax*, and that Dilatation being cauſed *partly* by the *Intercoſtal Muſcles* drawing up the Ribs, and *partly* at the ſame time the *Diaphragme* by its *Contraction* drawing downward the lower ſmall Ribs, to which 'tis joyned, and alſo lifting up the *Viſcera* of the lower Belly, by which they do *joyntly* make all the ſpace, they can, for the Air to come in and diſtend the Lungs: It muſt hence neceſſarily follow, that the *Intercoſtal Muſcles* and the *Diaphragme* being conſtituted for two diſtant Employments (though both to the ſame end) and *neither* being able to perform the *others* Office, where one ceaſeth from it's work, the other for the exigence of Nature muſt take more pains to

ſupply the others defect. Which is very evident to be ſeen; for, the *Diaphragme* being made uſeleſs by looſing its *Nerves*, the * *Intercoſtal* Muſcles do dilate the Ribs much more than formerly, even to the utmoſt diſtance they can, when there is need for it; as, when you make the Dog run a little after he is cut, or when you gallop a *Wind-broken Horſe*, doth manifeſtly appear.

3. The *manner* of Reſpiration being the ſame in a *Dog*, whoſe * Diaphragme-nerves are cut, and in a *Wind-broken Horſe*, 'tis more than probable, that the *Cauſe* may be as nearly the ſame, as the *Signes* are; and that, though there may be *other* faults found in the Lungs of ſuch Creatures, yet 'tis very likely, they may be induced from the *weakneſs* of *Reſpiration*, but that they had their *Occaſion* from the *Relaxation* or *Rupture* of the *Nerves* of the Diaphragme at firſt: which will ſeem more credible, if we remember, that by the ſtreining of the Midriff too much (by which * the *Nerves* may be quite broken or ſtretcht beyond their proper tone) moſt commonly that accident happens.

Anatomical
Obſervations on a Humane *Body, dead of odd Diſeaſes; as they were communicated by Dr.* Nathanael Fairfax.

Some deſcription of hypochondriacks.

A Young Maid of *Rumborough* in *Suffolk*, when ſhe was about thirteen years of age, took *Chalybeats* for the Green-ſickneſs, and found ſome relief by it, but was after much pent in her wind. From 16. to 22. ſhe much afflicted her ſelf for the Death of her Father and Mother, and the misbehaviour of a Brother; during which time, ſhe had every year an *acute* diſeaſe or two. At 18, ſhe was very weakly, clogg'd in her Cheſt, and melancholy. If ſhe went out in a windy day, ſhe was fain to make haſt in; for the wind, *ſhe ſaid*, was ready to choak her. She was a very ſlow Walker, going up-hill or up-ſtairs with much difficulty. She was now obſerved to be very *thirſty*, uſually drinking at Bed-time, and in the night too, ſometimes; elſe, *ſhe ſaid*, ſhe ſhould be choak't with drought. Between 21. and 22. of her age, going down ſtairs, ſhe heard a frightful Jolking in her Breaſt; which ſhe then made known to the reſt of the houſe, who when ſhe ſhew'd them the manner of it by ſhaking her Body, joyn'd all with her in the wonder, concluding (as moſt would have done by the noiſe) that her Breaſt was almoſt full of water. She took ſe-

veral

veral things of Dr. *Browne* and others at *Norwich* for about ſix moneths time, without finding relief. Half a year after, toward *Michaelmas*, upon taking a ſlight cold, ſhe was ſo ſtop't up, that ſhe could only whiſper; nor could ſhe lie flat, but rear'd up with pillows. I being ſent for, cauſed preſently a Vein to be open'd, as an Expedient only to make way for a freer Circulation, and room for Nature to disburthen her ſelf. Within leſs than an hour ſhe got breath, and ſoon after grew as well as ſhe was before. She affirm'd, ſhe never ſwet in her life, nor could it be procur'd by *ordinary* Sudorificks. Being deſirous to adde an Empirical remedy, I gave her three of *Matthews* Pills; which did ſweat her lightly, but beyond what ever ſhe remembred. Several daily *doſes* of *Lockiers* Pills, 4. *per doſe*, remov'd the Julking, *as ſhe ſaid*, lower to the Mid-riff: when ſhe, fearing an *Hyper-catharſis*, laid them by for two or three daies, and then taking them up again, could find no further alteration by them. She could never lie on her left ſide. In the 23. year of her age, in Winter, ſhe had a dangerous *Feaver*, with a *Diarrhœa*, but came off. In her 24. in Winter again, ſhe got cold, was quite ſtopt up, after five or ſix daies fell into Convulſion ere ſhe was bled, through want of care in thoſe about her. By late bleeding ſhe had preſent eaſe, and chear'd up in the Evening, but died the next Morning.

I had leave from her ſelf, whilſt living, and from her Relations, when dead, to open her Body; which I did accordingly.

Firſt therefore I cleav'd aſunder the Breſt-bone from the Cartilage, called *Enſi-formis*, to the neck; when, laying open the hollow of the *Thorax*, there ſteam'd out at firſt a very offenſive ſmell, notwithſtanding the ſharp froſt, there was at that time, it being about *Chriſtmas*. Then making way to lay open either ſide of the *Sternum*, I was ſurpriſed to ſee (as I thought) almoſt the whole Cavity of the *Thorax* empty above, (as the Body lay ſupine) and fill'd with nothing but *thick Milk* beneath. But ſearching further, I found there was only all the right ſide of the Cheſt, and about a third part of the left, in that condition. It took up, in the part to the neck-ward a hand-breadth, and ran three fingers thickneſs to the left of the *Mediaſtinum*. The Liquor was like *Cream*, or rather like a ſize of *Spaniſh White*, having a caſt of yellow, like *Beeſtings*. For, putting a ſpoon into it, from the

bottom

Observations on the Dead Body.

bottom I took up a thick clammy matter, juſt like that *Spaniſh White*, that ſinks to the bottom of its ſize. In quantity it might be about three *pints*, contain'd in a *Bag*, which was capable to hold as much more and better. The *bag* ran along from the left ſhoulder to the utmoſt of the right ſide of the *Mid-riff:* not ſtreight along nor ſtifly ſtretcht; but about a hand-breadth from its riſe it went directly down to the Midriff, with which it cloſed all along. Its skin or coat was thicker than that of the ſtomack, as well as its capacity larger, in as much as the Flexures of the Ribs joyn'd with it, and made up above half the compaſs. Where it adher'd to the Mid-riff, 'twas near a finger thick: And in one place, where I endeavor'd to ſeparate it from the Mid-riff, I hit upon a thinner *bagg*, whence iſſued out 2 or 3 ſpoonfuls of ſhier water: How it got in, I found not. The *Mediaſtinum* was either wholly waſted, or elſe woven into the thickneſs of the *Bagg*, as was alſo the *Pleura*, as far as the *Bagg* reach'd. It lay looſe and flapping from the left *Axillar* to the *Cheſt*, having been before fill'd and diſtended either with ~~lenid~~ Wind or the Liquor. All the hollow was bedabled with the wallowings of the liquor about, as is the Ouſe by the Ebbings and Flowings of the *Tide* in a Channel. That *Lobe* of the *Lungs*, which ſhould have been on the righ-ſide, was gone, and that on the left, waſted to near a third part. In the *Lower Belly* all was well.

Dr. *Brown* ſaith, he hath met with the like in an *Italian* Author. His opinion was to ſalivate her. I had thoughts of a *Paracentheſis*, or Tapping between the Ribs. For by the noiſe of the Liquor, and by her not enduring to lye on the left, I concluded it muſt be in a *Cyſtis* on the right. But if that had been done, the Bagg being too thick might have mortified. The Jolking was exactly like that of Water or Milk. This Woman was as Flat-breaſted as a Man. Whether the Liquor proceeded from the falling down of the *Chyle* from the *Axillars*, is a *Quære*, but ſeems to carry in it ſomewhat of probability. But I muſt not reflect.

Two other Anatomical *Obſervations*, *imparted*, *by the* ſame hand.

1. A certain Serving-man about 27 years of age, dyed *Hydropical*, which Diſeaſe he was moleſted with, 4 years before his death. He was

was ever a liſtleſs, dull and melancholy fellow, never cheerful nor ſmiling, eſpecially for ten years before he died. His words came from him as if forced, and ſpeaking but a little, he would end with a ſigh. When open'd, he was found to have the left *Lobe* of the *Lungs* almoſt quite waſted; but no Ulcer, nor ought preternatural appearing in the remaining part, except its waſting. The heads of the *Veſſels* and *branches* of the *Wind-pipe* as big, as in the other *Lobe*. That *Lobe* of the Liver, which buts on the Mid-riffe, was black *outwardly* for about a hand-breadth, and about a thumbs-breadth within the *Parenchyma*. Other parts ſound.

2. The other day I took notice in the *Corps* of a *Felon*, that, whereas *ordinarily* the *Preparing Veſſels* ariſe, on the *right* ſide, out of the *Cava*, as on the *left*, out of the Emulgent, his *right* Vas preparans ſprang cleerly from the *right Emulgent*.

Divers Inſtances *of* Peculiarities *of* Nature, *both in* Men, *and* Brutes; *Communicated by the ſame.*

1. One Mr. *Morley* of *Bury St. Edmunds* in an *Aſthmatick* diſtemper, was adviſed by ſome to take down a ſpoonfull of good Engliſh *Honey*; which being done, the *Patient* fell into an Univerſal ſwelling, as if he had ſwallow'd the worſt of *Poyſons*. Mr. *Goodrich* being haſtily call'd in, to ſave life, preſcribed him a common *Sudorifick*, which in competent time relieved him. They then made inquiry at the Apothecary's, Whether nothing were amiſs in the Honey; and they proteſted, it was altogether right. But to be aſſur'd of it by *Experiment*, they afterwards got the like quantity at another place, which was given with the very ſame frightful event, and the Party was cured by the ſame *Chirurgion* (who is my *Author*) with the ſame kind of ſweat *.

2. Mr. *Twiſſe*, a Miniſter of *Metigham* in *Suffolk*, about fourty years of age, having been accuſtomed for ſome time to drink *warm* or rather *hot* Beer,

* The like Example hath been more than once related to the *Publiſher* by a very credible perſon, of a Noble Lady in *Ireland*, who having received a ſmall hurt on her Leg, and the *Chirurgion* mingling in the Application, he made to it, a little *Honey* (from which ſhe hath an utter Averſion, which was then unknown to the *Chirurgion*, as was to the *Patient* the mixture;) the place affected did ſoon after rankle, and grow ſo bad, that the Lady was conſtrained to ſend for him that had applied it, who being examined about the *Ingredients*, and declaring one of them to be *Honey*, the Lady ſoon acquainted him with her *Antipathy* to that ſubſtance: whereupon that Application was immediately removed, and another more proper for the *Patient* put in the place, with good ſucceſs.

and coming from his Houſe about Mid-ſummer to a houſe near *Rumburch-Church*, where he was offered a Cup of *cold* Beer, out of modeſty, or a humor to prevent the being wondred at, took it off thus cold, after he had taken a Pipe of *Tobacco*. Which done, he preſently took horſe, and rode with other Company towards *Framlingham*. Coming at *Haleſwith*, he found himſelf ſick, his ſtomach much out of order. He lighted once or twice by the way and vomited, but coming at his Journeys end, his vomiting grew worſe, and he was conſtrain'd to betake himſelf to his bed. Next day he grew yet worſe, could find no help by Phyſick, but died the very next morning.

It may be worth noting (*adds the Author*) that one, who is wont to drink *cold* Beer, is not, for ought we know, endanger'd by a draught of *hot* Beer: But I cannot tell, whether it may be thence inferr'd, that *hot* things are more agreeable to the natural Tone of the Stomach, then *cold*. That it was not barely the coldneſs of particles, ſenſible to the Touch, appeares, becauſe the ſame Party could drink cold *Wine*, as I was inform'd from my own Father.

3. Madam *Mary Brook* of *Yoxford* hath ſuch an Averſion to *Waſps*, that whileſt their ſeaſon of ſwarming about in Houſes laſteth, ſhe is forc'd to confine her ſelf to a little cloſe Chamber, and dares not then come out to Table, leaſt their coming there ſhould put her into ſuch diſtempers, as *Cheeſe* doth thoſe, who have an utter Antipathy againſt it.

4. Mrs. *Raymund* of *Stow-market*, when ever ſhe hears *Thunder*, even a farr off, begins to have a bodily diſtemper ſeize on her. She growes faint, ſick in her ſtomach, and ready to vomit. At the very coming over of it, ſhe falls into a right down *Cholera*, and continues under a *Vomiting* and *Looſeneſs*, as long as the Tempeſt holds, and that in a more violent way, than is commonly procured by ſuch Medicaments as are uſually exhibited for thoſe very purpoſes. And thus it hath been with this Gentlewoman from a Girle.

5. I know a Woman in *Stow-market*, who, during her Greenſickneſs, was invited by her *Pica* or longing, to ſuck the *Wind* out of *Bellows*, which as often as ſhe could ſhe took into her Body with open mouth, forcing it in by blowing with her own hands, the

the Bellowes inverted. I know another that was for crackling of *Cinders* under her feet. From which kind of *Inſtances* I am inclin'd to doubt, whether that Diſtemper begins at the *Depravation* of the *Acid liquor* in the *Stomach*, and not rather at the *Uterus*, which next infects the *Brain*, ſuch kind of things gratifying the Fancy ſomewayes miſled, more than the *Appetite natural* any wayes depraved.

6. Somewhat, like to this, is to be found in *Brutes*. In *May* laſt a *Grey-hound* Bitch at *Brightwell-Hall*, about five or ſix dayes before ſhe caſt her Whelps, had ſuch a wild kind of Hunger (though ſhe was fed ſufficiently every day with uſual food) that, finding another Bitches Whelps, ſhe devour'd them all (4 or 5, as I remember) and fell next upon the Bitch her ſelf, who made a ſhift to get from her as well as ſhe could, being help'd. From this, and from *Sows* devouring whole *Litters* of Pigs, I am prone to think otherwiſe of the *Longings* of *Teeming-Women*, than is the common opinion.

A Confirmation
Of the Experiments, mention'd in Numb. 27, *to have been made by Signor* Fracaſſati *in* Italy, *by* Injecting Acid Liquors *into* Blood.

THe Honourable *Robert Boyle*, having ſeen the particulars inſerted in *Numb.* 27, concerning ſome Experiments made by Signor *Fracaſſati*, and recollecting, what himſelf had experimented of that nature, ſeveral years ago, was pleaſed to give to the *Publiſher* the following Information about it, by the favour of a Letter, written to him from *Oxford, Octob.* 19. 1667. *viz.*

Sir,

I *Hinted to you in my laſt ſomething about the* Original *of the Experiments, made in* Italy, *by* Injecting Acid Liquors into Blood: *To explain which, I ſhall now tell you, That about this time three years* * *I mentioned at* Greſham Colledge *to the Royal* Society *an odd Experiment, I had formerly made* (*not by* Chance, *but* De-

* The *Journals* of the Royal *Society* being looked into by the *Publiſher* (who, by the honour of his Relation to that *Illuſtrious Body*, hath the advantage of peruſing them, as he by his Office hath the Care of ſeeing them faithfully managed) do fully agree with the Affirmation of this Noble Perſon, as well in the *Circumſtance* of the *Time*, as the *Subſtance* of the *Matter* in queſtion; It being in the Month of *December* of An. 1664. when, what is novv alledged in this Letter, was publickly related by its *Author*.

ſigne) *upon Blood yet warm, as it came from the Animal,* viz. *That by putting into it a little* Aqua fortis, *or* Oyl of Vitriol, or Spirit of Salt (*theſe being the moſt uſual* Acid Menſtruums,) *the Blood not only would preſently looſe its pure colour and become of a* Dirty *one, but in a trice be alſo coagulated; whereas if ſome fine* Vrinous *ſpirit, abounding in* Volatil *Salt, ſuch as the* Spirit *of* Sal Armoniack, *were mingled with the warm Blood, it would not only not curdle it, or imbaſe its Colour, but make it look rather more florid than before, and both keep it fluid, and preſerve it from Putrefaction for a long time.*

This xperiment I devis'd, among other things to ſhew the Amicableneſs *of* Volatil *ſpirits to the* Blood. *And I remember 'twas ſo much taken notice of, that ſome very Inquiſitive Members of the* Society *came preſently to me, and deſired me to acquaint them more particularly with it; which I readily did, though afterwards I made ſome further Obſervations about the ſame Experiment, that I had no occaſion to relate.*

This having been ſo publickly done, though I ſhall not ſay, that Signor Fracaſſati *may not have hit, as well as I, upon the Experiments publiſhed in his Name, yet there is ſo little difference between the warm Blood of an Animal* out *of his Veins and* in *them, that 'tis not very improbable, that he may have had ſome imperfect Rumor of our Experiment without knowing whence it came, and ſo may, without any diſingenuity, have thence taken a hint to make and publiſh, what now is Engliſh'd in the* Tranſactions. *If it be thought fit, that any mention be made of what I related ſo long ſince, I think, I can ſend you ſome other Circumſtances belonging to it. For I remember, I tryed it with other Liquors (as* Spirit of Wine, Oyle of Tartar, Oyle of Turpentine,) *and I think alſo, I can ſend you ſome remarks upon the* Colour *of the* upper part of the Blood. *And I ſhall on this occaſion add in reference to* Anatomical *matters in* general, *that after I ſaw, how favourably the* Uſefulneſs *of* Experimental Philoſophy *was receiv'd, I was invited to inlarge it in another* Edition; *and for that, I provided divers Anatomical as well, as other Experiments, and deſign'd many more, ſo that I have by me divers things, that would not perhaps be unwelcome to* Anatomiſts, *&c.*

An Obſervation
About the Epiploon, *or the Double Membrane, which covers the Entrals of Animals, and is fill'd with* Fat.

This Obſervation ſhould have been added to thoſe that were publiſh't in Num-

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ber 27. *and made by* Fracaſſati *and* Malpighi. *For it is contain'd in an* Exercitation *De* Omento, *annexed to the* Tetras Anatomicarum Epiſtolarum Marcelli Malpighii *and* Caroli Fracaſſati de Lingua & Cerebro, *printed in* Bononia. *Since it was then omitted, it was thought worth the inſerting now*, viz.

THe *Epiploon*, being look'd upon by a good *Microſcope*, is like a great *Sack*, full of abundance of other ſmall Sacks, which do incloſe *Gatherings* of *Greaſe* or *Fat*. There are many Veſſels, which may be call'd *Adipous* or *Fatty*, which iſſue out of this *Membrane*, and ſpreading themſelves all over the Body, conveigh *Fat* to it, juſt as the Arteries carry the Blood all over the ſame. Whereever is *Fat* or *Greaſe*, there is found ſtore of theſe little *Sacks*, wherein *that* is incloſed, whence it is, that in lean and emaciated Bodies, in ſtead of *Fat*, you find nothing but *ſkins*.

The ſtructure of theſe *ſmall Sacks* and of the *Adipous veſſels* ſufficiently ſheweth, that the *Fatt* is not form'd accidentally out of the thick Vapours of the Bloud, as is the common belief. Nor is its chief *Uſe*, to foment the Natural heat; but it ſeems rather to conduce to the allaying of the *Acrimony* of the *Salts*, that are in the *Bloud* and the *Seroſities*. And indeed (*ſaith this Author*) Lean perſons, and thoſe, whoſe *Epiploon* hath been cut, are more ſubject than others to *Rhumatiſmes*, *Lienteries*, and the like diſeaſes that are cauſed by the *ſharpneſs* of the *Humours*. And thoſe that are *fatt*, are not ſo eaſily ſeized on by them, in regard the *Acrimony* of the *Seroſities* is corrected by the *Mixture* of the *Fatt*, juſt as the ſharpeſt *Lixiuium* will looſe its force, if *Oyl* be mingled therewith.

Some Hortulan *Communications about the curious Engrafting of* Orenges *and* Lemons *or* Citrons *upon one anothers Trees; and of one* Individual *Fruit, half* Orenge *and half* Lemon, *growing on ſuch Trees*, &c.

We have here *Orenge*-trees, (*ſaith the Intelligence* from *Florence*) that bear a fruit, which is *Citron* on one ſide, and *Orenge* on the other. They have not been brought hither out of other Countreys: and they are now much propagated by Engrafting.

2. This was lately confirmed to us by a very Ingenious *Engliſh* Gentleman, who aſſerted, that himſelf not only had ſeen, but bought of them *An.* 1660. in *Paris*, whither they had been ſent by *Genoa*-Merchants; and that on ſome Trees he had found an *Orenge*

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on one branch, and a *Lemon* on another branch; as alſo, (conſonantly to the *Florentine* information) one and the ſame Fruit half *Orenge* and half *Lemon*; and ſometimes *three quarters* of one kind, and *one quarter* of the other.

3. A *Provencal* at *Paris* pretends to keep *Orenge*-trees in that Town all the winter long *without* any *Fire*, though they remain in the Earth, and not be put in Caiſſes or Boxes. This is thought to be effected by a peculiar ſort of *Dung*, uſed for that purpoſe, and wrought deep into the Ground.

Q. *Why ſhould not the Experiment of ſome ſuch thing be made about* London, *whoſe* Latitude *is but ſo little more* North-ward *than that of* Paris?

Inquiries for Greenland.

To diſcharge our Promiſe made in the laſt Transactions, *we ſhall ſubjoyn the following* Queries, *which we alſo purpoſe to recommend in due ſeaſon, to ſome of thoſe* Engliſh *Maſters of Ships and other fit perſons that ſhall Sail into* Greenland *for the Whale-fiſhing: Intreating withal, as many as have conveniency, to aſſiſt us in theſe recommendations.*

The Inquiries *are*

1. WHat, and how much is the heat of the Sun *there* in the midſt of the Summer, compar'd with the heat of it in *England*? to be obſerved with a ſeal'd Thermometer.

2. What is the moſt conſtant weather there in Summer, whether Clear, Cloudy, Rainy, Foggy? *&c.*

3. What weather is moſt uſual at ſuch and ſuch times of the year?

4. What conſtancy or unconſtancy there is of the *Wind* to this or that quarter of the *Horizon*, or to this or that part of the *year*?

5. What the Temperature of each particular Wind is obſerv'd to be? And particularly, whether the *North-wind* be the coldeſt? If not, what wind is? whether is the colder, the *Eaſt* or *Weſt*, &c.

6. What wind is obſerved to bring moſt Ice, and what to make a clear water at Sea?

7. What *Currents* there are? How faſt, and which way they ſett? Whether thoſe Currents are not ſtronger at one time of the *Moon* than at another? Whether they always run *one* way?

8. What is Obſervable about the *Tydes*, Spring or Neap?

How

How high the *High-water mark* is above the *Low-water*? Which way it floweth? which way it ebbeth? what time of the Moon the *Spring-tides* fall out?

9. Whether the Ice that floats in the Sea be of Salt-water or Freſh?

10. What *Rivers* there are in the Summer, and what freſh water can be had?

11. What Fowl are found to live there, and what Beaſts? How they are thought to ſubſiſt in Winter? How they breed and feed their young?

12. What *Vegetables* grow there, and whether they yield any Flowers or Fruits, &c.?

13. Whether there have been any *Thunder* or *Lightning* obſerved in thoſe parts?

14. How deep the Cold penetrates into the Earth? whether there be any Wells, Pitts or Mines ſo deep, that the Cold does not touch the bottom thereof?

15. How the Land trends? and whither the Parts under or near the *Pole* be by thoſe, that have gone furtheſt that way, thought to be *Sea* or *Land*? How near any hath been known to approach the *Pole*; & whether the Cold increaſeth with the increaſe of *Latitude*?

16. To make, if poſſible, ſome Experiments and Obſervations about the *Magnet* or *Needle*; and particularly, How much the *Declination* is there? and whether they doe exactly obſerve the Degrees of *Declination* in their courſe? Likewiſe to make Obſervations about the *Height* of the *Sun* and other Celeſtial Bodies, and their *Diameter*, *Refractions*? *&c.*

17. What is their opinion concerning the *North-Eaſt* paſſage?

18. What Fiſh do moſt frequent thoſe Seas, beſides *Whales*? Any thing obſervable in their Fiſhing; as the Uſual or Unuſual bigneſs, ſtrength, and the ſeveral ſorts of *Whales*; and particularly to obſerve whether that kind of *Whales* they call *Trompa*, have in their *Heads* the *Sperma Ceti*, and in their *Entrals* the *Ambergreeſe*, looking like *Cows-dung*, as was alledged out of *Purchas* in *Numb.* 28. *pag.* 538?

19. To give in an exact Relation of the *Whale fiſhing*, throwing the Harp-irons, following the Fiſh, *&c.*

20. To deſcribe the whole manner of making the *Oyl* of *Whales*.

An Account of the

SYNOPSIS NOVÆ PHILOSOPHIÆ & MEDICINÆ *Franciſci Travagini* Medici Veneti.

SOme months ſince there were two *Letters* ſent hither from *Venice*, from Signior *Franciſco Travagino*, giving notice of a Treatiſe of his, ready for the Preſs, under the Title of *NOVA PHILOSOPHIA & MEDI-*

MEDICINA. Thoſe Letters came accompanied with a *Synopſis* in Print, giving a brief Account of the Contents of the ſaid Treatiſe, to this effect, *viz:*

That this *Author* hath compos'd a *Syſtem* of Natural Philoſophy by Obſervations and Experiments, accomodated to the benefit of Humane Life, and ſubſervient to *Phyſick* and other *ſubalternate* Arts; which *Philoſophy* he pretends to have raiſed on *Principles*, that are certain Bodies drawn out of *Mixts*; which, though in themſelves inviſible and incoagulable, yet become, according to him, viſible by their Contrariety and mutual Operation upon one another, and ſo do conſtitute the Temperaments of Concretes, and cauſe not only their Diſſolution, but alſo their Redintegration.

Theſe *Principles* he undertakes to prove to be *Two Salts*, call'd by him *Acidum* and *Salſum*; which, as they work more or leſs on one another, when blended, ſo they loſe more or leſs of their Volatility, and the degrees of their contrariety: And from their various Complication (in which he places the whole buſineſs and moment of *Philoſophy*) he holds, that that great Multiplicity of Concrets, which is in the *Univerſe*, does reſult.

In *Particular* he deduceth from the ſaid *Principles* the cauſe of *Ferments* and their Variety, the nature of *Generations*, *Concretions*, *Putrefactions*, *Precipitations*, &c. and ſheweth, how thoſe *Principles* run through all *Minerals*, *Vegetables* and *Animals*, by their manifold combinations, and various wayes of acting on one another.

He explains alſo the Mixtures of *Alkaly's*, *Vitriols*, *Armoniaks*, *Sulphurs*, *Mercuries*, and explicateth the Properties of *Diſſolvents*, as alſo *Taſts*, *Odors*, *Colors*, &c. all from the ſame principles.

And having raiſed this Structure of his, as far as he judgeth it ſufficient for *Subordinate* Arts, he proceeds to adapt it to the Art of *Phyſick*. And applying it to *Animal* Bodies, he thence drawes the Diverſity of Humors and Tempers, the Begining and Duration of Vital Heat, the Motion of the Limbs, the Faculties of Entrals, the Origin, Vitality and Properties of the Blood, and the various Fermentations therein; ſhewing the Diſtempers of the Ferments and Juyces in Animals, the nature of Coagulations, Diſſolutions, Feavers and other Symptoms; as alſo the Original of Poyſons in Animal Bodies; concluding with an Indication of the proper remedies (as he conceives) of many Diſeaſes.

Whether this Philoſophy be New, *is eaſie to Judge.*

A Note to be inſerted above, pag. 544. after lin. 12.

THis Reſt (by Mr. *Hooks* ſuggeſtion) may be rendred more convenient, if, inſtead of placing the Screw *Horizontal*, it be ſo contriv'd, that it may be laid *parallel* to the *Equinoctial*, or to the *Diurnal* motion of the Earth. For by that means the ſame thing may be perform'd by the ſingle motion of *one* Screw, which in the other way cannot be done, but by the turning of *both* Screws: As will eaſily appear to thoſe that ſhall conſider it.

In the *SAVOY:*
Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be ſold at the *Bell* a little without *Temple-bar*. 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, *December.* 9. 1667.

The Contents.

An Account of the Experiment of Transfuſion, *practiſed upon a* Man *in* London. *A Narrative of ſome Trials of Transfuſion, lately made in* France. *Some* New *Experiments of* Injecting *medicated Liquors into* humane *Veins, together with ſome conſiderable Cures perform'd thereby. An Extract of a Letter written from the* Bermudas, *giving an Account of the Courſe of the* Tides *there; of* Wells *both ſalt and ſweet, digg'd near the Sea; of the* Whale-fiſhing *there practiſed anew, and of ſuch Whales, as have the* Sperma Ceti *in them. A Method for finding the* Number *of the* Julian Period, *for any year aſſign'd, the* Number *of the* Cycle *of the* Sun, *the* Cycle *of the* Moon, *and of the* Indictions, *for the ſame year, being given. An Account of ſome Books.* I. PETRI LAMBECII LIB. PRIMUS PRODROMI HISTORIÆ LITERARIÆ. II. THOMÆ CORNELII PROGYMNASMATA PHYSICA. III. LES ESSAYS *de* PHYSIQUE *du Sieur de* LAUNAY. IV. FRANCISCI DU LAURENS SPECIMINA MATHEMATICA, duobus Libris comprehenſa.

An Account Of the Experiment of *Transfuſion*, practiſed upon a *Man* in *London*.

This was perform'd, Novemb. 23. 1667. *upon one Mr.* Arthur Coga, *at* Arundel-*Houſe*, *in the preſence of many conſide rable and intelligent perſons, by the management of thoſe two Learned Phyſitians and dextrous Anatomiſts Dr.* Richard Lower, *and Dr.* Edmund King, *the latter of whom communicated the Relation of it, as followeth.*

THe Experiment of Transfuſion of Blood into an *humane* Veine was made by Us in this manner. Having prepared

the *Carotid* Artery in a young Sheep, we inſerted a Silver-Pipe into the Quills to let the Blood run through it into a Poringer, and in the ſpace of almoſt a *minut*, about 12. ounces of the Sheeps-bloud ran through the Pipe into the Poringer; which was ſomewhat to direct us in the quantity of Bloud now to be Transfus'd into the Man. Which done, when we came to prepare the *Veine* in the *Man's* Arme, the Veine ſeem'd too ſmall for that Pipe, which we intended to inſert into it; ſo that we imployed another, about one third part leſſe, at the little end. Then we made an inciſion in the Veine, after the Method, formerly publiſht *Numb.* 28; which Method we obſerv'd without any other alteration, but in the ſhape of one of our Pipes; which we found more convenient for our purpoſe. And, having open'd the Veine in the Man's Arme, with as much eaſe as in the common way of Venæ-ſection, we let thence run out 6 or 7 ounces of Blood. Then we planted our ſilver-pipe into the ſaid Inciſion, and inſerted Quils between the two Pipes already advanced in the two ſubjects, to convey the *Arteriall* bloud from the Sheep into the Veine of the Man. But this Blood was near a *minut*, before it had paſt through the Pipes and Quills into the Arme; and then it ran freely into the Mans veine for the ſpace of 2. *minutes* at leaſt; ſo that we could feel a *Pulſe* in the ſaid veine juſt beyond the end of the Silver-pipe; though the Patient ſaid, he did not feel the blood *hot* (as was reported of the ſubject in the *French* Experiment) which may very well be imputed to the length of the Pipes, through which the blood paſſed, loſing thereby ſo much of its Heat, as to come in a temper very agreeable to Venal Blood. And as to the quantity of Blood receiv'd into the Man's Veine, we Judge, there was about 9. or 10. ounces: For, allowing this pipe $\frac{1}{3}$ leſſe, than that, through which 12. ounces paſs'd in *one* minute before, we may very well ſuppoſe, it might in *two* minuts conveigh as much blood into the Veine, as the other did into the Porringer, in *one* minut; granting withall, that the Bloud did not run ſo vigorouſly the ſecond minut, as it did the firſt, nor the third, as the ſecond, *&c.* But, that the Blood did run all the time of thoſe two minutes, we conclude from thence; *Firſt*, becauſe we felt a Pulſe during that time. *Secondly*, becauſe when upon the Man's ſaying,

He

He thought, he had enough, we drew the pipe out of his Veine, the Sheeps-bloud ran through it with a full ſtream; which it had not done, if there had been any ſtop before, in the ſpace of thoſe two minutes; the bloud being ſo very apt to coagulate in the Pipes upon the leaſt ſtop, eſpecially the Pipes being ſo long as three Quills.

The Man *after* this operation, as well as *in* it, found himſelf very well, and hath given in his own Narrative under his own hand, enlarging more upon the benefit, he thinks, he hath received by it, than we think fit to own as yet. He urged us to have the Experiment repeated upon him within three or four dayes after this; but it was thought adviſable, to put it off ſomewhat longer. And the next time, we hope to be more exact, eſpecially in weighing the Emittent Animal before and after the Operation, to have a more Juſt account of the quantity of Bloud, it ſhall have loſt.

A Relation
Of ſome Trials of the ſame Operation, lately made in France.

1. *M. Denys*, Profeſſor of the *Mathematicks* and *Natural Philoſophy* at *Paris*, in a Letter of his to the *Publiſher* relateth, That they had lately tranſmitted the Bloud of four *Weathers* into a *Horſe* of 26. years old, and that this Horſe had thence received much ſtrength, and more than an ordinary ſtomach.

2. The ſame perſon was pleaſed to ſend to the ſame hand a Printed *Letter*, written to the Abbot *Bourdelot* by M. *Gadroys*, being an *Anſwer* to a Paper of one *M. Lamy*, and confirming the *Transfuſion* of Blood by New Experiments. In this *Anſwer* the *Author* is vindicating the *Transfuſion* from Objections; where firſt he takes notice, That, whereas the *Objector* undertakes to refute the Experiments made, by ſimple *Ratiocinations*, it ought to be conſidered, that the *Quodlibeticall* Learning of the *Schools* is capable enough to find Arguments *for* and *againſt* all ſorts of Opinions, but that there is nothing, but *Experience*, that is able to

give the Verdict and the laſt Deciſion, eſpecially in matters of *Natural Philoſophy* and *Phyſick*: That a hundred years agoe, there were no Arguments wanting to prove, that *Antimony* or the *Vinum Emeticum* was poyſon; the uſe of it being then forbidden by a *Decree* of the *Faculty* of *Phyſitians*; and that at this day there are no arguments wanting, to prove the contrary, and to aſſert, That it is a *Purgative* of great importance, follow'd with wonderfull effects; the ſame *Faculty* having Publiſht a *Decree* the laſt year, by which it permits, and even *ordains* the uſe thereof. So that it ought to be ſaid, that *Sole Experience* hath determin'd this matter, and that the Recovery of many perſons, and amongſt them, of the *Moſt Chriſtian King* himſelf, hath more conduced to convince Men of its uſefulneſs, than all the bare Ratiocinations, that could be employed to defend it. And ſo it is with all *Remedies*, there being not one, that is not approved by ſome *Phyſitian* or other, who thinks to have reaſon on his ſide, and diſapprov'd at the ſame time by others of that Profeſſion, who conceive to have it on theirs: Whereas *He* certainly is to be eſteemed the moſt *Rational*, that in theſe matters is guided by good *Experience*. And ſince the *Tranſfuſion* of *Blood* is a *New* thing, (unknown for ought we know) to all former Ages, Ingenious Men, and Lovers of the Increaſe of the Stock, ſerving for the relief and conveniencies of Human Life, do no more, in this particular, than propoſe and recommend it to Generous and Un-prejudicate *Phyſitians*, to Judge of its agreeableneſs to *Human* Bodies, and to make trials of it accordingly; themſelves eſteeming, that ſince it concerns the Health and Life of Man, it cannot be examined too ſeverely; though at the ſame time they conceive, that 'tis unequal, to ſtand herein to the verdict of ſuch Arrogant Men, who from a ſelf-conceit of knowing all things already, are very impatient at any thing diſcover'd, which they have not thought on themſelves: Thoſe Men being the beſt adviſed and the moſt to be relyed on, who do not precipitate their Judgment, but ſtay for many Experiments, carefully made, to conclude themſelves by. For which purpoſe, the *Author* wiſhes, that Perſons in power would cauſe a good number of Experiments of this Invention to be made, and examine them either themſelves, or give order to prudent and free-ſpirited *Phyſitians* and *Chyrurgians* to do ſo.

Among

Among the *Objections*, (which the Author finds to be generally grounded upon inconſiderations, miſtakes, and a ſuppoſition, as if peremptory Affirmations touching the effects of this Transfuſion were obtruded, whereas all is left to the ſucceſs of Experiments faithfully made) there is one, directed againſt the *effects* of that operation, which appeared in the young Man, who (by Mr. *Denys*'s Relation in his Printed *Letter* to Monſieur de *Montmor*) after he had received the Arteriall Blood of a Lamb, was cured of an extraordinary *Lethargy*, conſequent to a violent Feaver, wherein he had been let blood 20. times. And the *Objection* is, That the lively apprehenſion, the ſaid young man had of a remedy ſo unuſuall, and whereof the ſucceſs could not but appear very dubious to him, and ſo render him exceedingly anxious, did ſo rouſe his ſpirits, and put them into ſuch motion, as to diſengage them from that embaraſment, which hindred their diffuſion; upon which dis-entanglement follow'd all the other good effects, that are imputed to the Transfuſion.

To this Conceit the *Anſwerer* replyes, That, if the *Apprehenſion* could have cur'd this young Man, the cure would doubtleſs have been effected 24. hours before the *Transfuſion*, becauſe he then hapned to have a very great one, by falling down ſtairs; as was alſo obſerved in Mr. *Dennys* his *Relation* of this Experiment. Beſides, that this Patient was noted to be ſo far from apprehending or fearing this Operation, that he did not ſo much as know, what the *Transfuſion* was; but thought, the Lamb was onely applyed to his Arm, to ſuck from him his ill Bloud, as he was made to believe, after an ancient and uſuall way.

To that Objection, wherein ſome put weight, *viz.* That there is a great difference between the *Fleſh*, we eat for food, and the Blood, that is tranſmitted *immediately* into the Veines; the *former* undergoing a great Alteration, which the *latter* does not: Our *Author* replyes, That of the three principall Digeſtions of the Aliment, that have been alwayes diſtinguiſht by Authors, the *Firſt*, which is made in the Stomach, is not conſiderable in compariſon of the two others, which are made of the *Chyle* and the *Bloud*, in the Heart, the Liver, and generally in all the parts, that receive nutrition: Which he illuſtrates by this, that as the Concoction, which is made of the Juyces of the Earth in the Root

and

and Heart of the Trunk of a Tree, does not ſo much ſerve to the production of this or that Fruit, as the laſt *Filtration*, that is made of thoſe Juyces in the ſmall *Fibres* of the Grafts; ſo alſo all thoſe Digeſtions, which are ſuppoſed to be made in the Stomack and the Heart or the Liver of Animals, do not ſo much ſerve to give the particles of the aliment thoſe *Figures*, which they require to be converted into the ſubſtance of Man, as the *diverſity* of *pores*, that ſtraine them laſt of all, and differ in the Bones, Fleſh, Cartilages, and other parts; in which the Ancients for this reaſon did admit as many different Aſſimilating faculties. Now, *ſaith he*, though the New Bloud, which is given in the *Transfuſion*, undergoes not the *firſt* Concoction, made in the Stomack, yet it ſuffers the two others, in making many Circulations together with the *native* bloud; and that therefore nothing hinders, but it may be fit to be changed into the ſubſtance of Man, without inconvenience.

The reſt of the *Objections*, here alledged, ſeeming to be of no moment, though anſwer'd by our *Author*, we ſhall here paſs by, and, for a generall anſwer to all, employ Experience, and the ſeverall ſucceſsfull Transfuſions, he relates; as thoſe of *Lambs-bloud* into *Dogs*, which, after the ſpace of ſeveral moneths from the time of the Operation, do not onely live, but are very well, and ſome of them grown fatter, than they were before; and of *Kids-bloud* into a little *Spaniel-bitch*, of 12. years of age, which, a little while after the Operation, grew vigorous and active, and even proud in leſs than eight dayes. To which he adds a conſiderable Experiment, lately made upon a perſon, that had been for three weeks afflicted with the complicated diſtempers of an Hepatick Flux, a Lientery, and a bilious Diarrhæa, accompanied with a very violent Feaver; and had been attended by four Phyſitians, who having blouded, purged, and clyſtered him, as much as they thought fit, he grew at laſt ſo weak, that he was unable to ſtir, loſt his ſpeech and ſenſes, and vomited all he took: whereupon they altogether deſpairing of and abandoning the Patient, and declaring, that they did ſo, in the preſence of divers perſons of honor, conſented to have the Experiment of Transfuſion made upon the Patient, which his Relations had propoſed, as the laſt Refuge; very unwilling, to omit any thing, that might ſeem probable to reſcue a dying

Man,

man. M. *Denys* and M. *Emmerey* were beſought to employ this laſt ſuccours. But they, ſeeing the deplored ſtate of the Sick, abſolutely refuſed to make the tryal, alledging, that the Transfuſion was not a means to reſtore either the ſolid parts, or to cure a Gangrene, which was apparently in his Inteſtins; they ſhould have uſed it ſooner, and at the very time, when the great evacuations of bloud were made in the Patient. But, notwithſtanding all this, they were exceedingly preſſ'd, to comply with their deſires, and not to let their friend dye without trying all means poſſible. They, being overcome by this importunity, and having ſecured their honor and ſafety, by the declaration above mentioned of the Phyſitians, and by their conſent to the tryal of this Experiment, transfuſed into his veins a ſmall quantity of *Calves*-bloud in a morning; whereupon, though this Patient was already in a Lethargy, and convulſive, and had a very low and creeping pulſe, yet, behold, an unexpected change hapned to him. His pulſe grew higher in an inſtant, and became more vigorous; his Convulſions ceaſed; he look'd fixedly on the By-ſtanders, ſpoke pertinently, and in divers languages to thoſe, that ſpoke to him, and fell into a very quiet ſleep. Awakening three quarters of an hour after, he took ſeveral broaths for the reſt of the day, not vomiting at all, nor having any ſtool, although for three dayes before he could take nothing at the mouth, nor had had any intermiſſion of his looſeneſs ſince the very beginning of his ſickneſs. Having thus remained for 24. hours, his forces began to diminiſh again, and his pulſe to grow low, and the looſeneſs to return. His friends then urged a ſecond Transfuſion, which being at laſt performed the next morning, the Patient indeed recover'd ſome vigour again, but that was of a ſhort duration. For though then alſo he took his broath well, without vomiting, yet he voided ſtill by ſtool, and at noon he began to decline, and about 5. at night he dyed, without the appearance of any convulſions. His Body being opened before the Phyſitians, the *Ileon* was found return'd into it ſelf from the top to the bottom, and below that knot unto the *anus* the Bowels were all livid, gangren'd, and of an unſupportable ſtench. His *Pancreas* was extraordinarily hard, and ſo obſtructed, that the *Pancreatick* Juice had no liberty to diffuſe it ſelf into the Guts.

His

His *Spleen* was very thick, and his *Liver* big, and in ſome places livid. The *Heart* very dry, and, as 'twere, burnt. And having found the Vein, by which the Transfuſion had been made, there was, from the place of the opening of the Arm, to the Heart, almoſt no bloud found in it, no more than in the other Veins, nor in the Ventricles of the Heart, for as much as that little, he received, had been imbibed by his hot and drie Fleſh. All which, this *Author* aſſures, can be atteſted both by a douzen perſons of great veracity, who were preſent at this diſſection, and confirmed by the *Certificats* given by the Phyſitians themſelves, to be ſent to the Parents of the deceaſed Stranger; who is the very ſame with him, of whom a leſs punctual account was given *Numb.* 28. *p.* 519.

Some New Experiments

of Injecting Medicated liquors into Veins, together with the conſiderable Cures, perform'd thereby.

This was lately communicated in a Letter from Dantzick *written by Dr.* Fabritius, *Phyſitian in Ordinary to that City, which out of the Latin we thus Engliſh.*

FOraſmuch as we had a great deſire to experiment, what would be the effects of the Chyrurgerie of Injecting liquors into *Humane* Veins, three fit ſubjects preſenting themſelves in our Hoſpital, we thought good to make the Tryal upon them. But ſeeing little ground to hope for a manifeſt operation from only *Altering* Medicines, we eſteemed, the Experiment would be more convenient and conſpicuous from *Laxatives*; which made us inject by a Syphon about two drachmes of ſuch a kind of Phyſick into the *Median*-Vein of the right Arm. The Patients were theſe. *One* was a luſty robuſt Souldier dangerouſly infected with the *Venereal Diſeaſe*, and ſuffering grievous Protuberatings of the bones in his Arms. He, when the purgative liquor was inſed into him, complained of great pains in his Elbows, and the little valves of his Arm did ſwell ſo viſibly, that it was neceſſary by a gentle compreſſion of on's fingers to ſtroke up that ſwelling towards the Patients ſhoulders. Some 4. hours after, it began to work, not very troubleſomely; and ſo it did the next day, inſomuch that the Man had five good ſtools after it. Without any

other remedies thoſe protuberances were gone, nor are there any footſteps left of the abovementioned Diſeaſe.

The *two* other Trials were made upon the *other* Sex. A married woman of 35. and a ſerving Maid of 20 years of age, had been both of them from their Birth very grievouſly afflicted with *Epileptick* fits, ſo that there was little hopes left to cure them. They both underwent this operation, and there was injected into their Veins a *Laxative Roſin*, diſſolved in an *Anti-Epilepticall* Spirit. The *firſt* of theſe, had gentle ſtools, ſome hours after the Injection, and the next day the fits recurring now and then, but much milder, are ſince altogether vaniſht. As for the other, *viz.* the *Maid*, ſhe went the ſame day to ſtool 4. times, and ſeveral times the next; but by going into the air, and taking cold, and not obſerving any diet, caſt her ſelf away.

'Tis remarkable, that it was common to all three, to vomit ſoon after the injection and that extremely and frequently; the reaſon whereof we leave to intelligent Phyſitians to aſſigne.

An Extract

Of a Letter, written from the Bermudas, *giving an account of the Courſe of the* Tides *there, of* Wells *both* Salt *and* Sweet, *digg'd near the Sea; of the* Whale-fiſhing *there practiſed anew, and of ſuch* Whales, *as have the* Sperma Ceti *in them.*

This Letter was written June 18. 1667. *by that Intelligent Gentleman, Mr.* Richard Norwood, *living upon the place, and relating as follows;*

SIR,

I Received your Letter of *October* 24. 1666. but, whereas you mention another formerly ſent, that never came to my hands: Neither had I, before the receipt of yours, the leaſt intelligence of the Inſtitution of the R. *Society*, founded by the King; but am very glad, that God hath put into the heart of his Majeſty, to advance ſuch a Noble deſigne, and ſhould rejoyce, I were able to add my Mite for the furtherance of it. As to the particulars, you recommend to me, I ſhall anſwer to them, as I can, in the order, I find them

Firſt, touching the Conjunction of *Mercury* with the *Sun*,

which you ſay you gave me notice of in your firſt, not received, and which happened *Octob.* 25. 1664. I had alſo notice of it from Mr. *Street*, and had provided in ſome meaſure to obſerve it; but the skie was ſo overcaſt, that the Sun could ſcarce be diſcerned all that day.

Next, concerning the *Tides*, I have only taken a general notice of them; as, that it is high water about 7. of the clock on the *Change*-day (in ſome Creeks an hour or two later.) The water riſeth but little, as about 4. foot at a high water; but at the Spring-tides, it may be a foot more. The Tides *without* are very various in their ſetting. Sometimes the Tide of Floud ſets to the *Eaſt-ward*, ſometimes to the *Weſt-ward*: but in fair, calm and ſettled weather the ſaid Tide ſets from the *South-eaſt*, toward the *North-weſt*, as they ſay.

We digg *Wells* of *freſh water* ſometimes within 20 yards of the Sea or leſs, which riſe and fall upon the Floud, and ebb as the Sea doth; and ſo do moſt of the Wells in the Country, though further up (as I am inform'd.) Whereſoever they digg Wells here, they digg till they come almoſt to a Level with the Superficies of the Sea, and then they find either *freſh*-water or *ſalt*. If it be *freſh*, yet if they digg 2. or 3. foot deeper, or often leſs, they come to *ſalt*-water. If it be a ſandy ground, or a ſandy crumbling Stone, that the water ſoaks gently through, they find uſually *freſh*-water; but if they be hard Lyme-ſtone-rocks, which the water cannot ſoak through, but paſſeth in chinks or clefts between them, the water is *ſalt* or brackiſh. Yet (to mention that by the by) I never ſaw any ſand in the Country ſuch as will grind glaſſe, or whet knives, &c. as in *England*, but a ſubſtance like ſand, though much ſofter; neither have we any *Peble-ſtones* or *Flint*.

For the *killing* of *Whales*, it hath been formerly attempted in vain, but within theſe 2. or 3. years, in the Spring-time and fair weather, they take ſometimes one, or two, or three in a day. They are leſs, I hear, than thoſe in *Greenland*, but more quick and lively, ſo that if they be ſtruck in deep water, they preſently make into the deep with ſuch violence, that the Boat is in danger to be haled down after them, if they cut not the rope in time. Therefore they uſually ſtrike them in ſhoal-water. They have

have very good Boats for that purpoſe, mann'd with ſix oars, ſuch as they can row forwards or backwards, as occaſion requireth. They row up gently to the Whale, and ſo he will ſcarcely ſhun them; and when the Harpineer, ſtanding ready fitted, ſees his opportunity, he ſtrikes his Harping-Iron into the Whale, about or before the Fins rather than toward the Tayl. Now the Harping-Irons are like thoſe, which are uſual in *England* in ſtriking Porpoiſes; but ſingular good mettal, that will not break, but wind, as they ſay, about a mans hand. To the Harping-Iron is made faſt a ſtrong lythe rope, and into the Socket of that Iron is put a Staffe, which, when the Whale is ſtruck, comes out of the Socket; and ſo when the Whale is ſomething quiet, they hale up to him by the rope, and, it may be, ſtrike into him another Harping-Iron, or lance him with Lances in ſtaves, till they have kill'd him. This I write by relation, for I have not ſeen any kill'd my ſelf. I hear not, that they have found any *Sperma Ceti* in any of *theſe* Whales; but I have heard from credible perſons, that there is a kind of ſuch as have the *Sperma* at *Eleutheria*, and others of the *Bahama*-Iſlands (where alſo they find often quantities of *Amber-greeſe*) and that thoſe have great teeth (which ours have not) and are very ſinewy. One of this place (*John Perinchief*) found one there dead, driven upon an Iſland, and, though I think ignorant in the buſineſs, yet got a great quantity of *Sperma Ceti* out of it. It ſeems, they have not much Oyl, as ours, but this Oyl, I hear, is at firſt like *Sperma Ceti*; but they clarifie it, I think, by the fire. When I ſpeak with him (whom I could not meet with at preſent, and now the Ship is ready to ſet ſail) I ſhall endeavour to be further informed; but at preſent with the tender of my humble ſervice to the *Royal Society*, and commending your Noble Deſigne to the bleſſing of the Almighty, I take my leave, &c.

A Method

For finding the Number *of the* Julian Period *for any year assign'd, the* Number *of the* Cycle *of the* Sun, *the* Cycle *of the* Moon, *and of the* Indictions, *for the same year, being given: together with the* Demonstration *of that Method.*

IN these *Transactions*, *N°*. 18. *p.*324. is a *Theoreme* for finding the Year of the *Julian Period*, by a new and very easie Method, which was taken out of the *Journal des Scavans N°*. 36. as it had been proposed and communicated by the Learned Jesuite *De Bill*

Multiply the { *Solar* / *Lunar* / *Indiction* } *Cycle* by { 4845. / 4200. / 6916. } Then divide

The sum of the Products by 7980 (the *Julian Period*) the Remainder of the Division, without having regard to the Quotient, shall be the Year inquired after.

Some Learned Mathematicians of *Paris*, to whom the said *P. de Billy* did propose this Probleme, have found the Demonstration thereof, as the same *Journal* intimates.

There being no further Elucidation of the said *Theoreme* since publisht, Mr. *John Collins*, now a Member of the *R. Society*, communicated what follows, *viz.*

That the *Julian Period* is a Basis, whereon to found *Chronology* not lyable to Controversie, as the Age of the *World* is: And 'tis the Number abovesaid, to wit 7980, which is the Product of 28 the } *Solar Cycle.*
19 the } *Lunar.*
15 the } *Indiction.*

Concerning this *Julian Period*, the late Arch-bishop of *Armach*, *Usher*, in the Preface to his learned *Annals*, advertiseth, that *Robert Lotharing*, Bishop of *Hereford*, first observed the Conveniencies thereof: 500 years after whom it was fitted for Chronological uses by *Joseph Scaliger*, and is now embraced by the Learned, as such a limit to *Chronology*, that within the space of 7980. years, the *Number* of the *Sun's Cycle*, the *Prime*, and the Year of the *Roman Indiction* (which relates to their ancient Laws and

and Records) can never happen alike. And these remarques being given, the year of the *Julian Period* is by the former Rule infallibly found.

This *Period* is used by the said Arch-bishop in his *Annals*, and is by him accounted to exceed the Age of the *World* 709. years. Those, that desire further satisfaction about *Æra's*, *Epocha's*, and *Periods*, may repaire to many Authors, and among them to *Gregorys Posthuma*, in English, *Helvici Chronologia*, *Ægidii Strauchii Breviarium Chronologicum*, who is one of the lateſt Authors.

Now as to the *Probleme* it self, it may be thus proposed.

Any Number of Divisors, together with their Remainders after Division, being proposed, to find the Dividend.

This thus generally proposed is no *new* Probleme, and was resolved long since, by *John Geysius*, by the help of particular Multipliers, such as those above-mentioned, and publisht by *Alstedius* in his *Encyclopædia* in *An.* 1630, and by *Van-Schooten* in his *Miscellanies*.

We shall clear up, what Authors have omitted concerning the *Definition* and *Demonstration* of such fixed Multipliers, *&c.* And therefore say, that each Multiplier is relative to the Divisor, to which it belongs, and thus define it;

It is such a Number, as Divided by the rest of the Divisors, or their Product, the Remainder is 0, *but Divided by its own Divisor, the Remainder is an* Unit.

We require the Divisors proposed to be *Primitive* each to other, *i. e.* that no two or more of them can be reduced to lesser terms by any common Divisor. For, if so, the Question may be *possible* in it self, but not resolvable by help of such Multipliers, such being impossible to be found. The reason is, because the Product of an Odd and an Even Number is alwayes Even, and that divided by an Even Number, leaves either Nothing, or an Even Number.

Divisors	28 19 15	The Multipliers relative thereto are	4845 4200 6916

The *Definition* affords light enough for the discovery of these Numbers. To instance in the *first*: The Product of 19 and 15 is

is 285, which multiply by all numbers ſucceſſively, and divide by 28, till you find the Remainder required. Thus twice 285 is 570, which divided by 28, the remainder is 10: Alſo thrice 285 is 855, which divided by 28, the remainder is 15. Thus if you try on ſucceſſively, you'l find, that 17 times 285, which is 4845, is the Number required, the which divided by 28, the Remainder is an *Unit*. Hence then we ſhall find, that

4845		19, 15, 17.
4200	is equal to the Solid or Product of	28, 15, 10.
6916		28, 19, 13.

More eaſie wayes of performing this *poſtulatum*, are to be found in *Van. Schootens Miſcellanies*, and *Tacquet's Arithmetick*, which perchance are not ſo obvious to every underſtanding.

For Illuſtration of the *Rule* propoſed, take this Example.

					Products.
In the year 1668.	*Cyclus Solis*	25	The Multiplyers.	4845	121125.
	Cyclus Lunæ	16		4200	67200.
	Indictio	6		6916	41496.
			The Sum of the Products ——		229821,

the which divided by 7980, the remainder is 6381, for the Year of the *Julian Period*; from which ſubſtracting 709, there remains 5672, for the Age of the World, according to Arch-Biſhop *Uſher*.

For DEMONSTRATION of this *Rule* we thus argue:

1. *Each Multiplier Multiplyed by its Remainder, is meaſured or divided by its own Diviſor, leaving ſuch a Remainder, as is propoſed.*

For before, each Multiplier was defined to be a *Multiplex* of its own Diviſor, plus an *Unit*. Wherefore Multiplying it by any Remainder, it doth onely render it a greater *Multiplex* in the ſaid Diviſor, plus an *Unit*, Multiplyed by the Remainder; which is no other, than the Remainder its ſelf; but if 0 remaine, that Product is deſtroyed.

2. *The Sum of the Products, divided by each reſpective Diviſor, leaves the Remainder aſsigned.*

For concerning the firſt Product, it is by the firſt *Section* meaſur'd

ſur'd by its own diviſor, leaving the remainder propoſed; and if we add the reſt of the Products thereto, we onely add a *Multiplex* of its own Diviſor, which in Diviſion enlargeth the *Quote*, but not the *Remainder*.

Particularly the ſecond Multiplier is 28 × 15 × 10 × Remainder, all which is but a *Multiplex* of 28.

And ſo the third Product is 28 × 19 × 13 × Remainder.

And what hath been ſaid concerning the Sum of the Products, being divided by the firſt Diviſor, and leaving the Remainder thereto aſſign'd, may be ſaid of each reſpectively.

3. *The ſum of the Products divided by the ſolid of the three Diviſors, leaves a Remainder ſo qualified as the ſaid Sum.*

For concerning the ſaid Sum, 'tis evident by the *ſecond* hereof, that it is no other, than the firſt Product, increas'd by *adding* a juſt *Multiplex* of the firſt Diviſor, that thereby we did only *enlarge* the *Quote*, not *alter* the *Remainder*. By the like reaſon, the *ſubſtracting* a juſt *Multiplex* thereof, doth only *alter* the *Quote*, not the *Remainder*; but the Solid of all three Diviſors, multiplied *here* by the *Quote*, as *there* by the *Remainder*, is no other than a juſt *Multiplex* of the firſt Diviſor. Wherefore the Remainder, after this Diviſion is perform'd, is of the ſame Quality, as the ſum of the Products, and divided by the firſt Diviſor, leaves the Remainder proper thereto: And the like may be ſaid concerning each Diviſor.

AS in the Method hitherto deliver'd, we required the Diviſors be *Primitive* to each other; ſo, if we take the *Probleme* as generally propoſed, in the Preface to *Helvicus* his *Chronologia*, we are told, common Arithmetick failes in the Solution thereof, and *Tacquet* denies it to be performable by the *Regula Falſi*, and being unlimited, we muſt do it by Tryals. Wherefore,

When any two Diviſors with their Remainders are propoſed, Try the Multiplices of one of them, increaſed by its Remainder, and Divide by the other: If you find ſuch Remainders, as are not for the purpoſe, and that they are repeated, the Probleme is impoſſible.

Example. Diviſors $\overset{6.}{8.}$ Remainders $\overset{3.}{5.}$

The

The Multiplices of 8, increaſed by 5, are } 13. 21. 29. 37. 45. 53.

Thoſe divided by 6, the Remainders are —— — 1. 3. 5. 1. 3. 5.

Here you ſee 21. and 45. for the purpoſe, and take the Progreſſion, adding the common difference 24 (which is the leaſt Dividend meaſured by 6. and 8.) and you have 21. 45. 69. 93. 117. 141.

Admit, the Queſtion had concerned theſe three Diviſors.

6 —— 3
8 the Remainders being 5 } Then dividing the former Progreſſion by
9 —— 6 } 9. the Remainders are 3. 0. 6. 3. 0. 6.

Wherefore I conclude, that the third and ſixth of theſe Numbers are thoſe ſought, to wit 69. or 141; and ſo on progreſſively: Whereas, if you had propounded the Remainder of 9. to have been any other Number, than 3, 0, 6, the *Probleme*, as concerning all theſe, had not been poſſible.

Some eaſie Caſes of the Probleme are theſe:

When the Remainder of ſome Diviſor is 0, and of each of the reſt of the Diviſors, an *Unit*, or leſſe by an *Unit*, then the Diviſor.

In which Caſes you are to find ſuch a *Multiplex* of the Product or leaſt Dividend meaſurable by thoſe Diviſors, that have Remainders, which, increaſed or diminiſh't by an *Unit*, may be a juſt *Multiplex* of that Diviſor, that hath no Remainder. Theſe Caſes are handled by *Tacquet*, and *Bachet* in his *Problemes plaiſans & delectables*.

PROBLEME.

To find the Year of the Julian Period for any Year of our Lord propoſed.

It is neceſſary to be furniſht with the *Suns Cycle*, the *Prime Numoer*, and the Number of the *Roman Indiction*, which the induſtrious Mr. *Street* thus performs:

When

When 1. 9. 3. *to the Year hath added been,*
Divide by 19. 28, *fifteen.*

The Remainders are the Numbers ſought. And hereby we found them for the year 1668. in the former Example.

The uſe of the *Prime* is, to find the *Epact*, and thereby the *Moons Age*, Time of *High Water*, &c.

A farther Uſe of the *Suns Cycle* is, to attain the *Dominicall Letter*, and thereby to know the *Day* of the *Week*, on which any Day of any Month happens. But this is more eaſily and with leſs caution obtained, by finding, on what Day of the Week the firſt of *March* happens for ever, according to ſuch *Rules* and *Verſes*, as I have elſewhere publiſhed.

In brief thus:

To the Number ——————— 2.
Add the Year of our Lord, ſuppoſe 1669.
An its Even fourth part, neglecting what remains, if any —— } 417.

The Sum -- ——————— 2088. Divide by 7. noting the Remainder, which ſhewes the Number of the Day of the Week, accounting *Sunday* firſt. If 0. remain, the *firſt* of *March* falls on a *Saturday*. In this Example there remains 2. ſhewing the *firſt* of *March* to fall on *Munday*.

If it were required, to performe this for years *preceding* our *Saviours Nativity*, then take this *Rule*;

To the Year adde its even fourth part, the Sum divide by 7, the Remainder ſhewes the Day of the Week, accounting *Sunday* firſt, *Saturday* ſecond, and ſo backward.

PROBLEME.

To find what day of the Month in the firſt Week of each Month, happens to be on the ſame day of the Week, as the firſt of March.

Uſe the (plain) following *Verſes*, in which the 12. Words relate to the 12. Months of the Year, accounting *March* the firſt;

Ask endleſs Comfort, God enough beſtows,
From Divine Axioms Faith confirmed grows.

The Alphabeticall Number of the firſt Letter of the word, proper to the Month propoſed, is the Anſwer;

Example.

If the Month were *April*, the word proper thereto is, *Endleſs*, and E is the fifth Letter in the Alphabet. Wherefore conclude, That the *firſt* of *March*, and *fifth* of *April* do for ever happen on the ſame day of the week; which for the year 1669. will be on *Monday*.

PROBLEME.

To find, on what day of the week the firſt day of each Month happeneth.

Suppoſing the firſt of *March* known, it might be reckoned from the former *Probleme*, but the following *Verſe*, beginning with *March*, as the former, is more ready for the purpoſe:

A Dreadful Fire, Beholders daily Gaze,
Chaſtized England. *Ah cruel fatall Blaze!*

Explication.

In the Year 1669. the *firſt* of *March* is Monday: I would know, on what *day* of the *week* the *firſt* of *October* happens. The word proper to the Month is *England*; then count Alphabetically to E, *viz.* A. Monday, B. Tueſday, C. Wedneſday, D. Thurſday, E. Friday, which is the day ſought. VVhence conclude, that the 1ſt, 8th, 15th, 22th, 29th days of *October* are all *Fridays*. Thence it is eaſie to reckon, on what day of the VVeek, any day of that Month happened; and ſo for all other Months.

PROBLEME.

To find, on what Day of the Month the Sun enters into any ſign of the Zodiack.

For this, *ex ſuper abundanti*, we give the following Verſe;

Charles *brought Content, divers effects enſue,*
Envy, Fear, Dolour, Danger, bids adieu.

Here again the 12. VVords relate to the 12. Months, *March* being the firſt.

To

To the Number of the Letter of the *Alphabet*, the word begins with, add 7.

Example. *Feare* is the word for *October*, and F. the sixth Letter: VVherefore the Sun enters into the 8. Signe, to wit *Scorpio*, on the 13. of *October*.

An Account of some Books.

I. PETRI LAMBECII LIB. PRIMUS PRODROMI *HISTORIÆ LITERARIÆ*, &c.

THe Author of this Book is now the *Historiographer* and *Library-keeper* to the Emperour. He publisht this Volume some few years agoe at *Hamburg*, the place of his Birth, (whence an Exemplar was but lately sent to the *Publisher.*) He was excited to this VVork by the complaint made by the Illustrious Lord *Verulam*, (*Lib.* 2. *cap.*4. *de Augm. Scientiarum*) of the want of a compleat *History* of *Learning*, that might give a *satisfactory* Account of the Rise, Progresse, Trans-migrations, Interruptions, Declinations, and Restaurations of all kind of Learning, Sciences, Arts, and Inventions; together with the *Occasion* of inventions through *all* Arts; the *Method* of teaching, and the *Manner* of improving and advancing them: Adding the various *Sects*, and the most famous *Controversies* among the Learned; the *Encouragements*, they received; the chief *Writings*, they composed; their *Schooles*, *Academies*, *Societies*, *Colledges*, *Successions*, *Orders*, and whatever belongs to the *State* of Learning.

This Grand *Desideratum* our Author undertakes to supply the VVorld with; and in order thereunto hath given us the *First Book* of the *Prodromus* of this History, and with it the *Four first Chapters* of the *Second Book*, together with an *Appendix*, containing a *Summary* of the Chief *Persons* and *Things*, he intends more fully and accurately to treat of in the remaining 32. Chapters, designed for the same *second* Book: To which he subjoyns two Tables of *Vniversall Chronography*, in the first whereof he exhibits the succession of all Ages from the Creation of the VVorld to the Beginning of the Common *Christian* Account; in the *other*, a Continuation of them from the Beginning of the said Account unto this present Age; In which *Tables* he gives a generall *Idea* of the Connexion of all Ages, as they are computed in respect of the

Vulgar *Christian* Account, either by Ascending to the Creation of the World, or by Descending to our Age: He also for the sake of this Work acquaints the Reader that he betook himself to the Explication and Castigation of the *Bibliotheca Chronologica Classicorum Authorum* JOHANNIS JACOBI FRISII *Tigurini*; substituting, *as he affirms*, a true Calculation in the place of a false one; reducing the Authors, there enumerated, to the true time of their Age; distinguishing what is supposititious from genuin, and adding many things, that were unhappily omitted. Which done, *he saith*, he proceeded from this Account of the Succession of Illustrious Writers, to the History of the *Origin*, *Increase*, *Nature* and *Constitution* of all Professions, Sciences and Arts; chusing the *Eight Books* of *POLYDORE VIRGIL de rerum Inventoribus*; and *DIOGENES LAERTIVS*, *De Vitis*, *& Dogmatibus veteris Græciæ Philosophorum*; as also, the *Eight Books* of *JOHANNES MIDDENDORPIVS De Celebribus Vniversi Orbis* ACADEMIIS.

He excuseth himself for having made no further progresse in this Desirable Work, alledging the difficulty and trouble of the Undertaking, the unavoidable interruptions he hath met with, and the narrowness of a private Mans fortune to carry on so Chargeable an Attempt, requiring a Royall encouragement and Assistance.

II. *THOMÆ CORNELII Consentini PROGYMNASMATA PHYSICA.*

This Author, a Friend to the *Cartesian* Philosophy, entertains the Curious in this Book with seven *Exercitations*, viz.

1. *De Ratione Philosophandi*: Where in the genuin Students of Naturall Philosophy he *first* requires the study of *Mathematicks*, to accustome their Minds to a fixed Attention, and to strict Reasoning; and *next* directs them to study Nature it self, and to labour after a true History of Nature: recommending *lastly* and particularly the Use of *Chymistry*, as an excellent key to open her Treasures, and the study of *Mechanicall* Principles, as nearly allyed to those of Nature.

2. *De*

2. *De Rerum Naturalium Initiis* : where he mentions the ſeveral *Hypotheſes* and Principles of Philoſophers, and approves of the *Carteſian*, eſteeming, that none ever looked ſo like truth, as thoſe; though he thinks them defective in this, that, how well ſoever they ſhew the production of things out of *Matter* variouſly modified, yet they ſeem not to have ſufficiently accounted for the efficient power thereof.

3. *De Univerſitate* : where he ſeems to be in a Maze, and thinks, That the *Structure* of the *Vniverſe* hath not been underſtood hitherto, nor will eaſily be hereafter.

4. *De Sole* : which *Luminary* he is inclin'd to believe to be a kind of Flaming Fire, appearing in a *Teleſcope*, like a Caldron full of boyling Mettal: where alſo he diſcourſes of the nature of *Light*, *Heat* and *Flame*; and affirms *Light* (as other *ſenſible Qualities*) to be not in the *Object*, but the *Sentient*; as *Pain* is not in the *Sword*, but in the *Animal* wounded by the Sword.

5. *De Generatione Hominis* : where, diſtinguiſhing between *Genitura* and *Semen*, and making the *former* to be that ſubſtance, which either Sex furniſhes to the *Fœtus*, and the *latter*, the Concrete of both Parents, He is of opinion, that that which he calls *Genitura*, conſiſts of two things. *Vid.* a *Craſſe liquor*, manifeſt to ſenſe; and of a very ſubtile and refined ſubſtance, containing all the virtue of Generation, and lodged in the former as its receptacle. Which having eſtabliſht, he affirms, that groſſer part of the *Geniture* not to be Bloud elaborated, but a Juyce, ſecreted from the Bloud, and being ſtrained through the *Corpus varicoſum* or *plexus pampiniformis* (wherein the ſeminal *arteries* are by innumerable *anaſtomoſes* ſo combined and interwoven with *veins*, that very hardly any naked eye can diſcern a Vein from an Artery) it paſſeth into peculiar fit veſſels, and is of a colour like that of the White of an Egg. As to the *Formation* of the *Fœtus*, he eſteems That, before the appearance of any Bloud, or the framing of any member, there are form'd all the lineaments of the Animal to come, though indiſcernibly; which he endeavours to make out very particularly, interweaving ſome Animadverſions on Authors of differing ſentiments, *and* mentioning ſeveral not un-philoſophical Hints.

6. *De Nutricatione* : Here the *Author* obſerves ſome things in the

the *Structure* of the *Stomach*, which he thinks highly considerable for the understanding of the action and use of this *Viscus*, and hitherto not taken notice of by others, that he knows. *Then* he teacheth, that the Food is not digested in the Stomach by *Heat*, nor by *acid* dissolving *Juyces* only, but that, many causes concurring to that digestion, the Aliment is there fermented both by the warmth of the Stomach it self, and of the neighbouring parts, but especially by the acrimonious steams, that pass through the *Gastrick* and *Splenick* Arteries into the Stomach, which advances also it's concoction by it's compressing and relaxing motions, and is assisted by an apt liquor, bedewing, dissolving, and diluting the meat, and so converting it into a Pulse or Creme-like substance. *Next*, he teacheth, that the *Chyle* passeth not through the Milky Veins (so called by *Asellius*) to the *Liver*, nor *all* of it through the *Channel* of *Pecquet* to the *Heart*, but a great part of it, through the common veins of the Stomach and the Mesentery, to the *Liver*. Nor will he admit, that the *Sanguification* is performed in any *one* part of the Animal, as the peculiar Shop or Elaboratory of it, whether Liver, Heart, Spleen, *&c.* Nor that the parts are increased and nourished by the red part of the Bloud: but that, as to the *former* action, it is done by the means of a liquor, and by hot steams, giving the red colour to the Chyle, as *Chymists* use to change *white* Juyces into *red*, by the affusion of *Oyl* of *Sulphur*, or the like liquors; *that* redness being much advanced by the motion and agitation of the bloud in the Veins and Arteries. But as to the *latter*, *viz.* the *Nutrition*, it is perform'd by that whitish Juyce, which is mixed with the Bloud, and separated from it by the straining Glanduls of the Body.

To these particulars he adds several not un-considerable remarks touching the *Gall*, *Spleen*, *Lymphatick vessels*, *&c.* Observing also, that the whole kind of *Birds* is destitute of *Milky* vessels; and occasionally taking notice, that *Worms* are bred in almost all the parts of Animal-bodies; of which he alledges very odd Observations and Histories.

7. *De Vita*: This he affirms to consist in the continued Motion of the Bloud, depending from that of the Heart; yet so that this latter proceeds not from the *heat* of the Bloud (as *Des-*

Cartes

Cartes would have it) but the moiſt ſteams and exſpirations of the Heart.

As for *Reſpiration*, he thinks it a vain opinion, that *thereby* the Heat of the Bloud is tempered and allay'd; but affirms, that it is therefore neceſſary, becauſe that the Bloud, which out of the *right* Ventricle of the Heart is propelled into the Lungs, in ſuch Animals, as are furniſht with them, cannot paſs into the *left*, unleſs the Air, breathed in, do ſwell and diſtend the ſmall branches of the Wind-pipe; it being from thence, that the ramifications of the *Arterial Vein*, through which the bloud muſt paſs, are compreſſ'd, and the bloud, therein incloſed, is protruded into the branches of the *venal Artery*; For the proof of which, he alledges divers Obſervations: Adding withall, that, ſince Animals, whilſt they are in the Womb, reſpire not, there being peculiar *ductus's*, by which the bloud paſſeth into the *Aorta*, without paſſing through the Lungs, as it alwayes doth in Animals deſtitute of Lungs; he doubts not, but that with art and care thoſe channels may be preſerved un-aboliſht, and made to grow and to be perfected with the other parts of the Animal, ſo that grown men may be brought to live the life of *Amphibious* Creatures. Nor doth he think this very difficult, in regard, that if their mouths and noſes were from their very infancy often ſtopt every day, and their breath ſo long intercepted, whilſt the bloud paſſeth through thoſe ductus's into the left ventricle of the Heart and the great Artery, the ſaid paſſages would never be dryed up: To confirm the poſſibility whereof, he alledges Examples of *Divers*, who from their childhood being given to ſwimming and diving, and ſo to the holding of their breath, did thereby ſo preſerve thoſe channels from being dried up, that upon occaſion they could ſtay a great while under water, as *Amphibiums* uſe to do.

LES ESSAYS PHYSIQVES du Sieur DE LAVNAY, Liv. premier.

THis Learned Man having propoſed to himſelf to go through the whole Body of *Natural Philoſophy*, by the way of *Eſſays*, divides that *Syſteme* into three Parts, ; whereof

The *Firſt* being *General*, is to treat of what is common to *all* Bodies,

Bodies, both *Superior* and *Inferior*: and is divided again into six Books; whereof the *first* considers the *Vniverse* in *generall*: the *second* is to discourse of *Place*, *Vacuum*, and *Time*, things as general as the *World*: the *third*, Of the material *Principles* of all Bodies: the *fourth*, of their *Efficient* Cause: the *fifth*, of their natural *Qualities*: and the *sixth*, of *Motion*, Generation, and Corruption of Bodies Inanimat and Animat.

The *second* part, is to examine the *Celestial Bodies*. The *Third*, shall treat of the *Terrestrial*, *viz.* the Elements, Meteors, Minerals, Plants, Brutes, Men.

Of this Work is now printed the *first* Book of the *first* Part, consisting of 5. Dissertations.

The *first* is about the Preliminary Questions of *Physiology*. The 2. inquireth whether the *Vniverse* is compounded of many Worlds. The 3. is of the Systyme of the World, its *Magnitude* and *Figure*. The 4. examins, Whether the World be animated? The 5. Whether it hath been or could be from Eternity? The 6. is concerning the End of the World.

IV. *FRANCISCI DV LAVRENS SPECIMINA MATHEMATICA, duobus Libris comprehensa.*

Horum Prior, SYNTHETICUS, *agit de Genuinis* Matheseos *Principiis in* genere; *in* specie *autem de Veris* Geometriæ *Elementis hucusque nondum traditis.*

Posterior, ANALYTICUS, *de Methodo Compositionis atque Resolutionis fusè disserit, & multa nova complectitur, quæ subtilissimam* Analyseos *Artem mirum in modum promovent.*

ERRATA, forgot to be corrected sooner.

IN N° 28. Pag. 521. lin. 22, 23. r. *She took dog (even before the wound was heal'd up) was with puppy.* p. 525. l. 8. r. *Answers that shall.* ibid. l. 20 r. *Mineral Queries.* p. 532. l. 18, dele, *viz.* p. 535. l. 2. r. *impelled at the Nose,* ibid. l. 15. r. *Grand poisson.*

In N° 29. p. 541. l. 18. r. *An intimation.* p. 544. l. 5. r. *from the Indexes.* ibid. l. 22. dele, *and as.* p. 545. l. 21. r. *breath out.* p. 548. l. 18. r. *with wind or,*

In the *SAVOY*,
Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be sold at the *Bell* a little without *Temple-Bar*, 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, *January* 6. 166$\frac{7}{8}$.

The Contents.

NEW Experiments, to the number of 16, *concerning the Relation between* Light *and* Air (*in* Shining Wood *and* Fish;) *ſhewing, That the withdrawing of the Air from thoſe and the like Bodies, extinguiſh's their Light, and the Re-admiſſion of Air reſtores it. An Account of two Books:* I. PATHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: in quo agitur de MORBIS CONVULSIVIS & SCORBUTO, ſtudio THOMÆ WILLIS M. D. II. ALPHABETVM NATVRÆ. Authore F. M. B. V. HELMONT.

New Experiments

Concerning the Relation between Light *and* Air (*in Shining Wood and Fiſh;*) *made by the Honourable ROBERT BOYLE, and by Him addreſſed from* Oxford *to the* Publiſher, *and ſo communicated to the ROYAL SOCIETY.*

SIR,

TO perform now the promiſe I made you the other day, I muſt acquaint you with what will perhaps ſomewhat ſurpriſe you, by giving you an Account of what I tried on Tueſday night laſt (Octob. 29. 1667.) *and the two or three following nights, about the* Relation *between* Air *and* Light, *as this is to be found in ſome Bodies.*

The Occaſion of theſe Trials was this. Having, as you know, long ſince made ſome Notes, chiefly Hiſtorical, upon particular Qualities, *and finding* Light *to be (how juſtly, I now diſpute not) reckon'd by the generality of Philoſophers among* Qualities, *I hudled together what Obſervations I had either made my ſelf, or received from ſome Ingenious Travellers (to whom I recommended my Inquiries) about* Shining *Bodies; And had alſo prepared ſeveral Trials about them, to be made when I ſhould have opportunity and requiſite Inſtruments to put them in*

practiſe, which, as to ſome of thoſe deſigned Experiments, have been long denied me. But having at length got hither one of my little Engines, *and having alſo procured, after much enquiry, a few ſmall pieces of* Shining Wood, *I began on the day abovementioned to try with them an Experiment, I found in my Liſt. And though the main Experiment be but one; I intended to ſet down what occurr'd to me about it but as ſeveral* Phænomena *of it; yet finding it requiſite, to acquaint you with ſome Trials, that are not ſo properly Parts of it, I ſhall for diſtinction ſake, propoſe them as ſeverall Experiments; the Narratives whereof are taken, for the moſt part,* verbatim *out of the Notes I ſet down for my own uſe, when the things to be regiſtred were freſhly done. Which advertiſement I give you, both to excuſe the careleſneſs of the Style, and to induce you not to diſtruſt a Narrative, that was made only to ſerve my Memory, not an* Hypotheſis.

Experiment I.

TO try, Whether or no a piece of *Shining Wood*, being put into a *Receiver* of our *Pneumatick Engin*, would, upon the withdrawing and re-admitting of the *Air*, ſuffer ſuch changes, as I have often obſerved a *Live Coal*, placed there, to doe; having at length procured a piece of ſuch Wood, about the bigneſs of a *Groat* or leſs, that gave a vivid light (for *rotten Wood*) we put it into a middle-ſized *Receiver*, ſo as it was kept from touching the Cement; and the Pump being ſet a work, we obſerved not, during the *five* or *ſix* firſt Exſuctions of the Air, that the ſplendour of the included Wood was manifeſtly leſſened (though it never was at all increaſed;) but about the *ſeventh* ſuck, it ſeemed to grow a little more dim, and afterwards anſwered our expectation, by loſing of its Light more and more, as the Air was ſtill further pumped out; till at length about the *tenth* Exſuction (though by the removal of the Candles out of the room, and by black Cloaths and Hats we made the place as dark as we could, yet) we could not perceive any Light at all to proceed from the Wood.

Experiment II.

WHerefore we let in the outward Air by degrees, and had the pleaſure to ſee the ſeemingly extinguiſht Light revive, ſo faſt and perfectly, that it looked to us all, almoſt like a little flaſh of Lightning, and the ſplendour of the Wood ſeemed rather

rather greater, than at all leſſe, than before it was put into the *Receiver*. But partly for greater certainty, and partly to enjoy ſo delightful a ſpectacle, we repeated the Experiment with the like ſucceſs as at firſt. Wherefore being deſirous to ſee how ſoon theſe changes might be produced, we included the Wood in a *very ſmall* Receiver of clear glaſs, and found, That in this the Light would begin to grow faint at the *ſecond*, or at leaſt at the *third* Exſuction of the Air, and at the *ſixth* or *ſeventh* would quite diſappear. And we found by a Minute-watch, that the ſending the Candles out of the room, the pumping out the Air till the Wood would ſhine no more, the re-admitting of the *Air* (upon which it would in a trice recover its Light) and the ſending in for the Candles to conſult the *Watch*, did in all take up but *ſix* Minutes.

Experiment III.

THe forementioned Experiment, without taking notice how long it laſted, being reiterated twice in this new Receiver, we had a deſire to ſee, whether this Luminouſneſs of our Wood would more reſemble a *Coal*, or the Life of a *perfect Animal*, in being totally and finally extinguiſht, in caſe the *Air* were kept from it a few minutes, or elſe the Life of *Inſects*, which in our exhauſted *Receiver* I had obſerved to loſe all appearance of its continuing, and that for a much longer time than a few minutes, and yet afterwards, upon the reſtitution of Air, to recover preſently, and ſhew manifeſt ſigns of Life? Wherefore having exhauſted the *Receiver*, till the Wood quite diſ-appeared, we ſtayed ſomewhat above a *quarter* of an hour in the dark, without perceiving, that the Wood had regained any thing of Light, though about the end of this time we made the place about it as dark as we could; and then it being too late at night to protract the Experiment, we let in the *Air*, upon whoſe admiſſion the Wood preſently recovered Light enough to be conſpicuous at a diſtance; though it ſeemed to me ſomewhat leſs vivid than before: which yet may be either a weakneſs in my ſight, or an effect of the ſteams of the Cement, unfriendly perhaps to the Luminouſneſs of the Wood.

Thus far we proceeded yeſter-night, to which we this night added theſe Obſervations.

We put in a piece of Wood bigger than the former (this being above an inch long) and that ſhone very vigorouſly. *And* having by a few ſucks quite deprived it of Light, we left it in the exhauſted *Receiver* for full half an hour, and then coming into the dark room again, we found all had not continued ſo ſtanch, but that ſome ſmall portion of *Air* had inſinuated it ſelf into the *Receiver*. This we concluded to be but a ſmall portion of *Air*, becauſe the Wood was but viſible to an attentive Eye. *And* yet, that it was really ſome *Air*, which was got in, that cauſed the little glimmering light, which we perceived, may appear by this, that it did preſently (as we expected) vaniſh at the firſt or ſecond ſuck; and then the *Air* being let into the dark *Receiver*, the included Wood preſently ſhone again as before: though I ſuſpected, I diſcerned ſome little diminution of its brightneſs; which yet, till further Trials of the like kind, and for a longer time, have been made, I dare not affirm. Before the *Receiver* was ſufficiently emptied at the beginning of the Experiment made with this greater piece of Wood, a ſmall leak accidentally ſprung, which, letting in a little *Air*, did ſooner than we intended, recall the almoſt diſ-appearing Light.

Experiment IV.

THere is an Experiment of affinity with the former, which we thought it not altogether impertinent to try. For having obſerved on another occaſion, That ſometimes the Operation, which the withdrawing the *Air* hath upon a Body included in the *Receiver*, proves more conſiderable *ſome minutes* after we have ceaſed pumping, than *immediately* after the exerciſe is left off, I imagined, that even in ſuch caſes, where the Light is not made wholly to diſ-appear (though it be made almoſt quite to do ſo) by the emptying of the Pneumatical glaſs, the ſuffering the Body to remain a while there, though without any pumping (unleſs now and then a very little to remove the *Air*, that might have ſtollen in in the mean time) the remaining Light of the Body might probably be further impaired, if not reduced quite to vaniſh. To examine this conjecture we put in a Body, that was not Wood, which had ſome parts much more luminous than the

reſt;

reſt; and having drawn out the Air, all the others diſ-appeared, and even the formerly brighter ones ſhone but faintly, when the Pneumatical glaſs ſeemed to be exhauſted. But keeping the included Body a while in that unfriendly place, we perceived the parts, that had retained light, to grow more and more dim, ſome of them diſ appearing, and that, which was formerly the moſt conſpicuous, being now but juſt viſible to an attentive Eye, and that ſcarce without diſpute. For, if we had not known beforehand, that a ſhining matter had been included in the *Receiver*, perhaps we ſhould not have found it out. And he that had the youngeſt Eyes in the company could not at all diſcern it: (the Air being let in, the Body began to ſhine again.) But this being a ſingle Trial, which the lateneſs of the night hindred us from reiterating, is to be further proſecuted, and in differing ſubſtances, before much be built upon it.

Experiment V.

THe *Rarefaction* or Expanſion of the Air having ſo notable an operation upon our ſhining Wood, I thought it would not be amiſs to try, what the *Compreſſion* of the Air would do to it. For which purpoſe we included a piece of it in ſuch a little Inſtrument to compreſſe, which you may remember to have been deviſed and propoſed by M. *Hook*. But though we impell'd the Air forcibly enough into the Glaſs, yet, by reaſon of the thickneſs requiſite in ſuch Glaſſes, and the opacity thence ariſing, we were not able *then*, to determine whether or no any change was made in the luminouſneſs of the Wood.

Which I thought the leſs ſtrange, becauſe by ſome Experiments purpoſely deviſed (at one of which I remember you were preſent) I had long ſince obſerved, That even a great preſſure from a fluid Body, which preſſeth more uniformly againſt all the Parts, it toucheth of the conſiſtent Body, does work a far leſs manifeſt change even on ſoft or tender ſubſtances, than one would expect from the force wherewith it compreſſeth.

And were it not, that one contrary oftentimes minds us of another, I might have forgot, that I had divers thoughts about finding ſome good ways of Trying, whether any ſuch change of Texture might be diſcovered to be made in the ſhining Wood by the

the abſence and return of the Ambient Air, as might with any probability have the loſs or recovery of the Woods ſplendour attributed to it. For I had formerly (if I were not miſtaken) found by ſeveral circumſtances, which I ſhall not now ſtay to name, That a ſlight (ſo it be an appropriated) variation of the Texture of this Wood, and which may ſeem mainly to reſpect the Pores (which perhaps ought to be of a determinate ſhape and ſize, and filled with a determinate matter) will have a great operation upon its ſplendour. And I formerly found by other trials, that even conſiſtent Bodies, if ſoft ones, may have their Pores enlarged and vitiated, and their bulk, and conſequently their texture (at leaſt as to their pores) manifeſtly enough altered by having the Air withdrawn from about them (whereby the Aerial particles within them were enabled to expand themſelves) and let in again, whereby, as to ſenſe, they ſeemed pretty well reſtored to their former ſtate. But the ſucceſs of my endeavours either with *Microſcopes* (through which a *vivid* piece of Wood will ſhine by its own light) or otherwiſe, was not conſiderable enough to deſerve a particular account; eſpecially in this Paper, where I am not to venture at matter of *Theory*.

Experiment VI.

THinking fit to try, Whether a *ſmall* quantity of Air, without being ventilated or renewed, might not ſuffice to maintain this Cold fire, though it will not that of a Live Coal, or a piece of Match, we cauſed a piece of ſhining Wood to be *Hermetically* ſealed up in a pipe of clear and thin glaſs: but though, carrying it into the dark, we found it had quite loſt its light, yet imagining that that might proceed from its having been over-heated (being ſealed up in a Pipe not long enough to afford it a due diſtance from the flame of the Lamp we employed to ſeal it,) we cauſed two or three pieces of freſh Wood, amounting all of them to the length of about two inches, to be ſealed up in a ſlender pipe between four or five inches in length; which being warily done, the Wood retained its light very well, when the Operation was over: And afterwards laying it by my bed-ſide, when the Candles were carried away out of the room, I conſi-

dered

dered it a while before I went to ſleep, and found it to ſhine vividly.

The next morning when I awaked, though the Sun was riſen, yet forbearing to draw open the Curtains of my bed, till I had looked upon the ſealed Glaſs, which I had fenced with a piece of Cloth, held between it and the window, my Eyes having not yet been expoſed to the day-light ſince the darkneſs they had been accuſtomed to, during the night, made me think the Wood ſhined brighter than ever. And this night after ten of the Clock, looking on it in a dark place, it appeared luminous all its length, though not ſo much ſo as in the morning.

The morning after, and the night after that, the ſame Wood did likewiſe manifeſtly, though not vigorouſly ſhine, eſpecially one piece, whoſe light was much more vivid than the reſt. And, for ought I know, I might have obſerved them to ſhine longer, if one of the ſealed ends of the Glaſs had not been accidentally broken.

Experiment VII.

WHilſt the former Trials were making, I was wiſhing for a good *Bolonian* Stone, to try what effect the withdrawing of the Air would have upon it. For though I knew it might be objected, that the Experiments of Light performable in our *Engine* muſt be made in the night, whereas the *Bolonian* Stone gains its light by being expoſed to the ſun-beams, yet that objection did not hinder my wiſh, ſince the better ſort of *Bolonian* Stones may be indued with a luminouſneſs by the flame of fire, or of large Candles.

I alſo wiſhed for ſuch a *ſhining Diamond*, as is now in the hands that beſt deſerve ſuch a Rarity, our *Royal Founder's*. For you may remember, that in the Obſervations I made of that Stone, and annexed to the Concluſion of the *Book* of *Colours*, I ſhow how it may ſeveral ways be brought to ſhine; ſo that by one or other of thoſe ways, eſpecially that of external Heat, I thought it very likely, I ſhould be able to make the light continue four or five minutes, which would be long enough to try in a very ſmall *Receiver*, exhauſtible at a Suck or two, whether the withdrawing and reſtoring the *Air* would have any viſible Operation on it?

I alſo

I alſo wiſht for ſome of the *Glow-worms*, with which I formerly made other Trials. For though I forgot not, what operation the withdrawing of the Air, by our *Engine* is wont to have upon living creatures, yet that made me not forbear my wiſh; not only becauſe of the different effect I have found the *Engine* to have on *Inſects* in reſpect of other Animals, but becauſe I am not of the opinion of thoſe modern Writers, who will have the Light of *Glow-worms* depend altogether upon their Life, and end with it. But being not likely by my wiſhes to procure any new ſubject to make trials on, I thought fit at leaſt to do what was in my power; and accordingly (to gratifie them, who, I preſumed, would, if preſent, propoſe ſuch a Trial) cauſed a piece of *Iron* to be forged, whoſe top was of the bigneſs of a Nutmeg; the reſt being a ſtemm, of an inch, or an inch and a half long, for which we provided a little Candleſtick of Tobacco-pipe-clay, which would not yield any ſmoak to fill and darken the *Receiver*. Then having heated the *Iron* red-hot, and placed it in this Clay, ſo that the round part was clearly protuberant, we conveyed it into a *Receiver* of white Glaſs, which was ſo placed as to keep the ſides at as good a diſtance, as we could, from the *Iron*, leaſt the exceſſive heat ſhould (as we much feared it would) break the Glaſs. Then ſending away the Candles, and making the Room dark, we haſtily pumped out the Air, but could not perceive the withdrawing of it had any operation on the glowing *Iron*. And though it continued ſhining long enough to give us opportunity to pump out and let in the Air three ſeveral times, yet we could nor obſerve, that the *Air* had any manifeſt operation one way or other. For though upon the withdrawing of the Air the *Iron* grew dimmer and dimmer, yet *that* I attributed to the *cooling* of it: and the rather, becauſe, having (to examine the conjecture) let in two or three times the Air, when the *Receiver* had been exhauſted, there appeared no manifeſt increaſe of Light upon the ſudden admiſſion of it.

Experiment VIII.

HAving formerly in our *Phyſico-Mechanichall* Experiments about the *Spring* of the *Air* obſerved, That the Air is thus far a Vehicle of *Sound*, that a Body but faintly ſounding, being placed

placed in our *Receiver*, gave a yet weaker ſound, when the Air was withdrawn from about it, then when the *Receiver* was full of Air: I preſumed, ſome curious perſons would, if they had been preſent, deſire to have a trial made, whether or no a ſmall piece of *Shining Wood* being ſo included in the *Receiver*, as that the Pumping out of the Air ſhould have no injurious operation upon the body of it, its Light would upon the withdrawing of the Air be manifeſtly diminiſht. And this I was the leſs backward to try, becauſe (not to mention the *Relation*, which the former Experiments ſhew there may be in ſome caſes between *Light* and *Air*) it did not readily occurr to my memory, that by any *manifeſt Experiment* (for I know, there are probable Reaſons to prove it) it appeared, that a Body more thin than Air will or can tranſmit Light, as well as other *diaphanous medium's*. And thoſe modern *Atomiſts*, that think, there is in our *exhauſted Receiver* very many times more *Vacuum* than *Body*, would, I preſumed, be glad to be ſupplied with an Argument againſt the *Peripateticks*, to ſhow, That the Motion of Bodies, *viz.* the Corpuſcles of Light, may be freely made in *Vacuo*, and proceed without the aſſiſtance of a Vehicle.

Wherefore having *Hermetically* ſealed up a ſmall piece of *Shining Wood* in a ſlender Pipe, and placed it in a ſmall *Receiver*, that was likewiſe made of clear Glaſs, we exhauſted it of Air, and afterwards let in again that, which we had excluded. But by neither of the Operations could we perceive any ſenſible decrement or increaſe of the Light of the Wood, though by that very Obſervation it appeared, that the Glaſs had been well ſealed, ſince otherwiſe the included Air would have got out of the Pipe into the *Receiver*, and have left the Wood without Light.

Experiment IX.

I Had alſo a mind to try, both what *degree* of *Rarefaction* of the *Air* would deprive the Wood of its ſplendour in ſuch and ſuch meaſures, and whether or no the ſelf-ſame Air, which, when rarified, would not ſuffer the Wood to ſhine, would, when reduced to its former denſity, allow it to ſhine as much as before.

This I propoſed to do by putting ſome Shining Wood into a

clear and conveniently ſhaped Glaſs, that the long Stem or Pipe being ſo far filled with *Quickſilver*, as that there might be about half a ſpoonful of Air left at the cloſed End, where the Wood was placed, it might be inverted into a little Glaſs of *Stagnant Quickſilver*, and therewith conveyed into a ſlender *Receiver*, out of which as the *Air* ſhould come to be pumped, *that* included in the Glaſs, which held the Wood, might be rarified, and afterwards upon the admiſſion of the outward *Air* (which muſt impell up the *Quickſilver* to its former height) might be reſtored to its former ſtate. But when we came to make trial of this, we had no *Receiver* conveniently ſhaped, that was ſo clear and thin, as that we could ſee the Wood ſhine through both the Glaſſes. And though we would for an Expedient have ſubſtituted a fine thin *Bladder*, wherein the Wood was to be put, and a convenient quantity of *Air* ſtrongly tied up with it, yet for want of a *Bladder* fine enough for our turn, that Expedient alſo proved uſeleſs to us. But being deſirous to make what trial we could by the leaſt unfit means, we had in our power, we got an old, but thin Glaſs, ſealed at one end, whoſe ſhape was pretty *Cylindrical*, and whoſe *bore* was about the bigneſs of a mans little finger, and whoſe length was about a foot or more. Into this Pipe near the ſealed end we put a piece of Shining Wood, wedged in with a piece of Cork to keep it from falling; and having inverted the noſe of it into another ſlender Glaſs, but not *Cylindrical*, wherein was pretty ſtore of *Quickſilver*, we put them both into a long *Receiver*, ſhaped almoſt like a *Glaſs Churn*, and having pumped a while, that the Air included in the Pipe, expanding it ſelf, might depreſs the *Quickſilver*, and ſo make eſcapes into the *Receiver*, as long as we thought fit; we then let in the outward Air, that the *ſtagnant Quickſilver* might be impelled into the cavity of the Pipe now freed from much of the Air, to the height requiſite for our purpoſe.

This done, we plied the Pump again, and obſerved, That, as the Air in the Pipe did by its own *Spring* expand it ſelf more and more, and grow thinner and thinner, the *Shining Wood* grew dimmer and dimmer, till at length it ceaſed to ſhine, the *internal Air* being then got a good way lower, than the ſurface of the *external* Quickſilver: whereupon opening the commerce between the cavity of the *Receiver*, and the *Atmoſphere*, the Quick-

ſilver

ſilver was driven up again, and conſequently, the *Air* above it was reſtored to its former denſity; upon which the *rotten Wood* alſo recovered its light. What the greateſt Expanſion of this *Air* was, we could not certainly determine, becauſe the Expanſion raiſed the *external* Quickſilver ſo high, as to hinder us to ſee and meaſure it. But we gueſſed, that the Air reached to about a foot or more from the top of the Pipe to the ſurface of the Quickſilver near the bottom of it. But, when that rarified Air was impelled into its former dimenſions, we meaſured it, and found, that the upper part of the Tube, unpoſſeſt by the Quickſilver, was about three inches; and the Wood being about an inch long, there remained two inches or ſomewhat better for the Air. But this Experiment is to be repeated, when exacter Inſtruments can be procured.

Experiment X.

THinking it fit to try as well, Whether *Stinking Fiſh*, that ſhines, be of the ſame nature as to Luminouſneſs with *Rotten Wood*, that ſhines too; as, Whether the withdrawing of the Air will extinguiſh or eclipſe the Light of a *conſiderable bulk* of luminous matter, as in the Experiments, hitherto made, we found it would do to a *ſmall* one: We took a Fiſh, that we had kept, and cauſed to be watched, till 'twas almoſt all over Luminous; though much more in the *Belly* and ſome parts of the Head, than elſewhere: And having ſuſpended him in a conveniently ſhaped *Receiver*, we found him to give ſo great a Light, that we ſuſpected beforehand, that the withdrawing of the Air would hardly have its full operation upon a *Body*, whoſe *bulk* was conſiderable, as well as its *light* very vivid, and which had many luminous parts retired to a pretty diſtance from the *Air*. *Accordingly* having exhauſted the *Receiver* as much as we were wont, it appeared indeed, eſpecially towards the latter end of the operation, that the abſence of the *Air* did conſiderably *leſſen*, and in ſome places *eclipſe* the light of thoſe parts, that ſhone leſs ſtrongly. *But* the *Belly* appeared not much leſs luminous than before: Wherefore ſuppoſing, that upon the turning of the *Stop-cock* the *Air* coming in much more haſtily than it could be drawn out, we ſhould have the beſt advantage to diſcern, what intereſt it had in the Lumi-

nouſneſs of the Fiſh, we re-admitted it, and upon its ruſhing in, perceived the Light to be as it were revived, and increaſed, thoſe parts of the Fiſh, that were ſcarce viſible before, or ſhone but dimly, receiving preſently their former ſplendour.

And not to leave un-proſecuted the remaining part of the Experiment, which was to try, Whether it was the *Kind* of the Luminous *Body*, or only the *Greatneſs* of the *bulk*, and the *Vividneſs* of *Light*, and, if I may ſo ſpeak, the *Tenacity* of the ſubſtance it reſided in, that made the difference between the *Fiſh* and the *Wood*; We put part of the Fiſh of another kind, that ſhone much more faintly, than *that*, hitherto ſpoken off, and but in ſome places; and by the withdrawing the *Air* we made ſome of the luminous parts diſappear, and the others ſo dim, as ſcarce to be diſcerned; and yet both the one and the other regained their former light upon the return of the *Air*.

And to purſue the Experiment a little further, we put in ſuch a piece of the firſt Fiſh, as though it were bright, was yet but thin and not conſiderably great, and upon pumping out the *Air*, we found it, according to our Expectation, quite eclipſed, though it recovered its Light upon the *Airs* re-entry.

THeſe, Sir, *are the Experiments, I have lately made about* Shining Bodies *in our* Engine. *More I would have tried, notwithſtanding the trouble we found in managing the Engine in the dark, if* rotten Wood *had not failed us, and if I were not in a place, where Glaſs-mens Shops are not near ſo well furniſht as the Stationers.*

I ſcarce doubt, but theſe Experiments will occaſion among the Virtuoſi *ſeveral* Quere's *and* Conjectures, *according to the differing* Hypotheſes *and Inquiſitions, to which men are inclined. And particularly 'tis probable, that ſome will make uſe of this Diſcourſe to countenance their Opinion, That notwithſtanding the* Coldneſs (*at leaſt as to ſenſe*) *of Fiſhes and other Animals, there may be in the* Heart *and* Bloud *a* Vital *kind of* Fire, *which needs Air, as well as thoſe Fires that are ſenſibly hot: Which may leſſen the wonder, that Animals ſhould not be able to live when robbed of Air. And if I had now time, I could poſſibly furniſh you with ſome other Trials, that ſeem much to favour the Compariſon, though, as to the Opinion it ſelf of a* Vital flame *I ſhall not now tell you my thoughts about it. And though not only the* Carteſians *will perhaps draw an argument from the paſt* Phænomena *in favour of their* Theory *of* Light, *but divers others will diſcourſe upon them, and propoſe further* Queſtions *and perhaps* Inquiries *ſutable to their ſeveral* Hypotheſes; *yet I ſhall content my ſelf at preſent to have faithfully delivered the* Hiſtorical *part of theſe* Apparences, *without making*

making, at leaſt at this time, any Reflexions on them. And the rather indeed, becauſe I enjoyed ſo little health, when I was making the Experiments, that 'twas not fit for me to engage in Speculations, *that would much exerciſe my thoughts, which, I doubt, have been more gratified, than my health hath been by the bare Trials, which are moſt ſeaſonably made at hours unſeaſonable for one, that is* not *well.*

POSTSCRIPT.

Sent by the ſame Noble Author *from the ſame place,* December 6. 1667.

MY condition in point of health being not much improved ſince I writ to you in October *laſt, when I ſhall have added, that I have not theſe five or ſix weeks been able to procure any* Shining Wood (*except one ſingle piece, which though large, was ſo ill conditioned, that it afforded me but one Trial*) *you will not, I hope, expect, that I ſhould adde much to the Experiments I formerly ſent you about the* Relation *'twixt* Light *and* Air. *But however, ſince the ſubject is New and Noble, and ſince your curioſity about other matters has been ſo welcome and uſeful to the* Virtuoſi, *I ſhall not decline even on this occaſion to comply with it, and the rather, becauſe I half promiſed you ſome* Additionals *a good while ſince, and becauſe too, that though, what I ſhall acquaint you with, may ſeem to be but a Confirmation of two or three of the former Experiments, yet, beſides that 'tis of them, which moſt needed a Confirmation, theſe Trials will alſo afford ſome Circumſtances, that will not, I think, be unwelcom.*

Experiment XI.

TO examine then the Conjecture, mentioned in the laſt Experiment, That the durableneſs of the Light in the *Shining Fiſh*, in ſpight of the withdrawing the Air, might proceed in great part from the Vividneſs of it, and the beauty of the matter it reſided in, rather than from the Extent of the Luminous Body in compariſon of the ſmall pieces of *Shining Wood*, I hitherto had made my Trials with; I put in, the above-mentioned piece of Wood, whoſe luminous ſuperficies might be perhaps ten or twelve times as great, as that, which the Eye ſaw at once of the

the ſurface of ſuch fragments of *Shining Wood*, as I was wont to employ: And though ſome parts of this large *Superficies* ſhined vividly (for the light was uſually enough, for rotten Wood, inferiour to that of our Fiſh) yet this great piece, being put into a convenient *Receiver*, was, upon the withdrawing of the Air deprived of Light, as the ſmaller ones had been formerly; the returning Air reſtoring its Light to the one, as it had done to the other.

Experiment XII.

BUt this is not the chief thing I intended to acquaint you with, *That* being the ſucceſs of ſome Trials, which we made in proſecution of theſe two neighbouring Experiments.

In the *firſt* of theſe I told you, I had been able to try but for half an hour or a little more, that a *Shining* piece of *Wood*, deprived in our *Engine* of Light, would yet retain a diſpoſition to be as it were re-kindled upon the freſh acceſs of the Air. Wherefore, though I could have wiſhed to have made a further Trial with the ſame kind of Bodies, yet being able to procure none, I ſubſtituted in their room ſmall pieces of *Rotten Fiſh*, that ſhone ſome of them more faintly, and ſome of them more vividly, in reference to one another; but none as ſtrongly, as ſome, that I could have employed: and having in a very ſmall and clear *Receiver* ſo far drawn off the Air, as to make the included Body diſappear, we ſo ordered the matter, that we kept out the Air for about 24 *hours*; and then allowing the Air to re-enter in a dark place and late at night, upon its firſt admittance the *Fiſh* regained its Light.

Experiment XIII.

THis, compared with ſome of my former Obſervations about *Putrefaction*, put me upon a Trial, which though it miſcarried, I ſhall here make mention of, that in caſe you, who are better furniſht with Glaſſes, think it worth while, you may get reiterated by the *Society*'s Operator. Conſidering then, how great an intereſt *Putrefaction* hath in the *Shining* of *Fiſhes*, and *Air* in the *Phænomena* of *Putrefaction*, I thought, it might be ſomewhat to the purpoſe, to take a Fiſh, that was, according to the common

mon courſe I had obſerved in Animals, not far from the ſtate, at which it would begin to ſhine: and having cut out a piece of it, I cauſed the reſt to be hung up again in a Cellar, and the exſected piece to be put into a ſmall and tranſparent *Receiver*, that we might obſerve, if a day or two, or more, after the Fiſh in the Cellar ſhould begin to ſhine, that in the exhauſted *Receiver* would either alſo ſhine, or (becauſe that ſeemed not likely) would, notwithſtanding the check, which the abſence of the Air might be preſumed to give the *Putrefaction*, be found to ſhine too, either immediately upon the admiſſion of the Air, or not long after it.

But this Experiment, as I lately intimated, was *only* deſigned and attempted, not compleated; the *Receiver* being ſo thin, that upon the exhauſtion of the *internal* Air, the *weight* of the *external* broke it; and we could ill ſpare another of that kind from Trials, we were more concerned to make: Notwithſtanding which we made one Trial more, which ſucceded no better than the former, but miſcarried upon a quite differing account, *viz.* becauſe neither the included piece of Fiſh, nor the remaining, though it were of the ſame ſort with the Fiſhes I uſuall employed, would ſhine at all, though kept a pretty while beyond the uſual time, at which ſuch Fiſhes were wont to grow luminous.

If this Experiment had ſucceeded, I had ſome others to try in proſecution of it, which I ſhall not now trouble you with the mention of. But that this *Paragraff* may not be uſeleſs to you, I'le take this occaſion to give you a Couple of *Advertiſements*, that may relate not only to this Experiment, but alſo more generally to thoſe, whether precedent or ſubſequent, where *Shining Fiſh* are employed.

Advertiſement I.

IN the firſt *place then, I will not undertake, that all the Experiments you ſhall make with* rotten Fiſh, *ſhall have juſt the ſame ſucceſs with theſe I have related. For as I elſewhere obſerved (in a* Diſcourſe *written purpoſely on that ſubject) that the event of divers other Experiments is not always certain, ſo I have had occaſion to obſerve the like about* Shining *of* Fiſhes. *And, beſides what I lately took notice of at the cloſe of the tenth Experiment, I remember, that having*

once

once designed to make Observations about the Light *of* rotten Fishes, *and having in order thereunto caused a competent number of them to be bought, not one of them all would shine, though they were bought by the same person I was was wont to employ, and hung up in the same place where I use to have them put, and kept not only till they began to putrifie, but beyond the time that others used to continue to shine; although a parcel of the same kind of Fishes, bought the week before, and another of the same kind, bought not many days after, shined according to expectation. What the reason of this disappointment was, I could not determine; only I remember, that at the time, it happened, the weather was variable, and not without some days of* Frost *and* Snow. *Nor is this the oddest Observation, I could relate to you about the* uncertain shining *of* Fishes, *if I thought it necessary to adde it in this place.*

Advertisement II.

Notice must also be taken in making Experiments with Shining Fish, *that their luminousness is not wont to continue very many days. Which Advertisement may be therefore useful, because without it we may be apt sometimes to make Trials, that cannot be soon enough brought to an issue; and so we may mistake the loss of Light in the Fish to be a deprivation of it caused by the Experiment, which indeed is but a cessation according to the usual course of Nature.*

Experiment XIV.

I Know not whether you will think it worth while to be told of a Trial, that we made to save those *Criticks* a labour, that else might perhaps demand, Why 'twas not made. We put therefore a piece of *Shining Fish* into a wide-mouthed Glass, about half filled with fair Water, and having placed this Glass in a *Receiver*, we exhausted the Air for a good while, to observe, Whether, when the pressure of the *Air* was removed, and yet (by reason of the Water that did before keep the Air from immediately touching the Fish) the Exhaustion of the *Receiver* did not deprive the Fish of that contact of Air, which it had lost before; Whether, I say, in this case the absence of the Air would have the same influence on the shining *Body*, as in the former Experiments: And here,

here, as far as the numerous bubbles excited in the Water would give us leave to diſcern it (for they did, though not unexpectedly, ſomewhat diſturbe the Experiment, which inconvenience we might have prevented, if we had thought it worth while) we could not perceive, that either the abſence or return of the Air had any great operation upon the Light of the immerſed Body: which yet did not keep me from intending to make a ſomewhat like Trial with *Shining Wood* (when I can get any) faſtened to the lower part of a clear Glaſs, and covered over, but not very deep, with *Quickſilver*. Of which practice I ſhall not now ſtay to give you the Reaſons, having elſewhere fully enough expreſſed them.

And that this *Section* may acquaint you with ſomething beſides the (ſeemingly) inſignificant Experiment related in it, I ſhall here inform you (ſince I perceive, I did not in the firſt Papers I ſent you) that though, when I formerly put together ſome Notes about Luminous Bodies, I confined not my Obſervations to one or two ſorts of Fiſhes, yet the Experiments, ſent you ſince *October* laſt, were all of them (except a *Collateral* one or two) made with *Whitings*, which among the Fiſhes, I have had occaſion to take notice of, is (except one ſort, that I cannot procure) the fitteſt for ſuch Trials, and conſequently fit to be named to you, to facilitate their future ones, in caſe you think it requiſite to make any upon ſuch ſubjects.

Experiment XV.

THe other of the two neighbouring Experiments, I lately mentioned (*viz.* the ninth) I told you, when I ſent it you, needed a reiteration to confirm it, ſince we had but once tried it (and that without all the conveniency we deſired) that a Shining Body, which upon the firſt withdrawing the Air looſeth *much*, but not *all* its Light, may be deprived of the reſt by continuing in that unfriendly place, though the Air be no further exhauſted. To proſecute therefore both the Experiments in one Trial, we took ſomewhat late at night a piece of rotten Fiſh, which we judged to ſhine too ſtrongly, to be quickly deprived of *all* its *Light*, and having put it into a ſmall and clear *Receiver*, we found (as we had foreſeen) that the Light was much *impaired*, but nothing near

ſuppreſſed by the withdrawing of the Air. Wherefore having removed the *Receiver* into a convenient place, I cauſed it to be brought to me about midnight (after I was a bed) and having by cloſe drawing the Curtains, and other means, made the place pretty dark, I perceived the included Body to continue to ſhine more vividly, than one would have expected, (and, if I miſtake not, I ſaw it ſhining in the morning, whilſt it was dark;) but the night after, coming to look upon it again, its light appeared no more: notwithſtanding which, I made a ſhift to keep out the Air about 24 hours longer, and ſo after 48 hours in all, we opened the *Receiver* in a dark place, and preſently upon the ingreſs of the Air were pleaſingly ſaluted with ſo vivid an Apparition of Light, that the included Body continued to ſhine, when carried into a room, where there was both Fire and Candle, if it were but by a *Hat* ſcreen'd from their beams.

Being encouraged, as well as pleaſed with this ſucceſs, we forthwith exhauſted the Air once more out of the ſame *Receiver*, and having kept it about 4 hours longer, we lookt upon it again in a dark place, and finding no appearance of Light, let the Air in upon it, whereby it was made to ſhine again, and that vigorouſly enough, ſo that I cauſed the *Receiver* to be exhauſted once more; but that it being *Sunday* night, I was unwilling to ſcandalize any, by putting my Servants upon a laborious, and not neceſſary work.

The ſuddenneſs, with which the included Body appeared to be, as 'twere, re-kindled upon the firſt contact of the Air, revived in me ſome ſuſpicions I have had about the poſſible cauſes of theſe *ſhort-liv'd apparitions* of Light (for I ſpeak not now of *real* Lamps, found in Tombs, for a reaſon to be told you another time,) which diſcloſing themſelves upon mens coming in, and conſequently letting in freſh Air into Vaults, that had been very long cloſe, did ſoon after vaniſh. Theſe thoughts, as I was ſaying, occurr'd to me upon what I had been relating, by reaſon of the ſudden operation of the freſh Air upon a Body, that but a minute before diſcloſed no light. For, though the Lights reported to have been ſeen in Caves, quickly diſappeared, which that of our Fiſh did not; yet that difference might poſſibly proceed from the Tenacity, or ſome other Diſpoſition of the matter,

wherein

wherein the Luminouſneſs of the Fiſh reſides. For I remembred, that I had more than once obſerved a certain glimmering & ſmall Light to be produced in a ſort of Bodies upon putting them out of their former *Reſt*, and taking them into the Air, which ſparks would vaniſh themſelves ſomtimes within one minute, ſometimes within a few minutes. But as theſe thoughts were but tranſient conjectures, ſo I ſhall not entertain you any longer about them, but rather contenting my ſelf with the hint already given, take notice of what may be more certainly deduced from our Experiment, which is, That the Air may have a much greater intereſt in divers odde *Phænomena* of Nature, than we are hitherto aware of.

And for Confirmation of our Experiment I ſhall adde, that, having in another *Receiver* eclipſed a piece of Fiſh, that ſhone when 'twas put in more languidly than divers others that we had tried, I kept it about three days and three nights in a *Receiver*, which (*Receiver*) being ſomewhat like another, at firſt ſuggeſted to me, when I came to take it, ſome ſcruple, but afterwards, upon further examination, concluded it to be the ſame; wherefore I opened it in the dark, and upon letting in the Air on this Body, that ſhined but faintly at firſt, it immediately recovered its ſo long ſuppreſſed Light: and having included another piece that was yet more faint than this, when it was put into the *Receiver*, I thought fit to try at once the Experiment hitherto confirmed, and the *Converſe* of it. And therefore having kept this piece alſo three days and three nights in the exhauſted Glaſs, I let in the Air upon it, and notwithſtanding the darkneſs of the place nothing of life was thereupon revived. But this being little other than I expected from a Body, that ſhined ſo faintly when 'twas put into the *Receiver*, and had been kept there ſo long, I reſolved to exerciſe my patience a while as well as my curioſity, and try, Whether the Appulſe and Contact of the Air would have that operation *after ſome time*, that it had not *at firſt*; and accordingly, after having waited a while, I obſerved the Fiſh to diſcloſe a Light, which though but dim, was manifeſt enough; but having conſidered it for ſome time, I had not leiſure to watch, whether 'twould increaſe, or how long 'twould continue.

I know not, *Sir*, whether you are weary with reading, but I am ſure I am quite tired with making ſo many Experiments upon *one*

Subject; and therefore I ſhall here conclude this Paper, as ſoon as I have added this Confirmation, as well of what I laſt related, as of ſomething that I obſerved before, That having included in ſmall *Receivers* two pieces of *rotten Whitings*, whereof the one, before it was put in, ſcarce ſhone ſo vividly, as did the other after the *Receiver* was exhauſted; and having ordered the matter ſo, that we were able to keep out the Air for ſome days, at the end of about 48 hours we found, that the more ſtrongly ſhining Body retained yet a deal of Light. But afterwards looking upon them both in a dark place, we could not perceive in either any ſhow of Light. Wherefore having let in the Air into that *Receiver*, whereinto the *Body* that at firſt ſhined the faintlier had been put, there did not enſue any glimmering of Light for a pretty while: nay, upon the ruſhing in of the Air into the other Glaſs (then alſo made acceſſible to the *Atmoſphere*) the body that at firſt ſhone ſo ſtrongly, and that continued to ſhine ſo long, ſhewed no glimmering of Light. *But* being reſolved to expect the iſſue a while longer, our patience was rewarded within leſs than a quarter of an hour with the ſight of a manifeſt Light in the *Body* laſt named, and a while after the other alſo became viſible, but by a light very dimm. The more luminous of theſe *Bodies* I obſerved to retain ſome Light 24 hours after: and the hitherto recited Experiment had this peculiar Circumſtance in it, That the two *Receivers* were un-interruptedly kept exhauſted no leſs than 4 days, and as many nights *.

* *What method the Noble Author of theſe Experiments uſed in keeping out the Air for ſo long a time, will probably be made known ere long by himſelf.*

An Account of two Books.

I. PATHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: in quo agitur de MORBIS CONVULSIVIS & SCORBUTO, ſtudio THOMÆ WILLIS, *M. D.*

WHat this excellent *Author* formerly promiſed of the whole *Pathology* of *Brain* and *Nerves*, he gives in this *Book* a very conſiderable *Specimen* of. The knowledge of the Diſeaſes which uſe to affect theſe parts, is eſteemed very difficult and intricate, and particularly the true Cauſes of *Convulſions* are of a very deep reſearch. For the clearing them up, this Author Philoſophiſeth

losophiseth after this manner. He teacheth, that there are indeed *Animal* Spirits; that they constitute the *Being* of the *Corporeal* Soul, and are also the *next* and *immediate* Instruments of all Animal motions, producing them by a kind of *Explosion* or Shooting; upon which *Elastick*, or *Explosive* power he establish's his whole *Doctrine* of *Convulsions*. To which he annexes a Disquisition of the *Scurvey*, as being near of kin to the same Doctrine, and grounded upon the same *Hypothesis*.

The First *part consists of* XII *Chapters.*

1. OF Convulsive Motions in *general*.
2. Of the *Epilepsy* or Falling-Sickness.
3. Of the differences of the *Epilepsy*, and the Causes of some of the *Symptoms* thereof; together with a Draught of the method of Curing this Disease.
4. Of the other kinds of Convulsions, and particularly of those in *Children*.
5. Of the Convulsive fits in *grown* and *aged* persons, proceeding chiefly from the vitiated *Origin* of the Nerves.
6. Of those Convulsive Motions, whose Cause lies about the *Extremities* of the Nerves, or within the *Plexus nervei*.
7. Of those that are caused by Liquors, bedewing the nervous Bodies, and irritating the whole processes of them into Convulsions: where are considered the Cramps that arise from Poysons.
8. Of the *Universal* Convulsions, that are wont to be caused in Malign, or ill Judged, and some anomalous Feavers: where are described the *Epidemical* and Maligne Convulsive Distempers, formerly reigning in some parts of *Germany*, as also that *Epidemical* Feaver, which raged *An.* 1661 in *England*, and did principally afflict the Brain and Nerves.
9. Of those that proceed from the *Scorbutick* Disposition of the *Nervous Juyce*.
10. Of *Hysterick* passions, where he maketh the *Womb* plead *Not guilty*.
11. Of those Passions, that are vulgarly called *Hypochondriacal*, shewing, that they are chiefly Convulsive; where by the by he treateth of *Chalybeat* Remedies.
12. Of Convulsive *Coughs* and *Asthma's*, and their Cure.

The

The Second *part contains XI Chapters.*

1. A Deſcription of the *Scurvy*; its internal and *next* Cauſe to be principally in the Bloud, and ſometimes in the depraved Juyce of the Nerves.

2. Of the *remoter* Cauſes of the *Scurvy*, and whence the Maſs of the Bloud, and conſequently the Nervous Liquor, receive its depravation.

3. Of the *Differences* of the Scurvy, its Signs and Symptoms, and chiefly ſuch, as ariſe from the *Bloud* being tainted.

4. Of thoſe Accidents, which happen in the Scurvy by reaſon of the *Brain* and the *Nervous Stock* being vitiated.

5. Of the Symptoms that ariſe from the conjoyned Diſtempers of the *Bloud* and the *Nervous Juyce*.

6. Of the *Prognoſticks* of the Scurvy; where he takes notice, that a *prevailing* Scurvy at laſt uſhers in a *Dropſie* or a *Conſumption*.

7. Of the *Cure* of the Scurvy; where, among other Remedies, he mentions ſeveral *Specificks* for this Diſeaſe.

8. Of ſuch Medicaments as reſpect the Scurvy, cauſed in a *Hot* Conſtitution, and in a *Sulphury-ſalin* Diſtemper of the *Bloud*.

9. Of the Cure of the various and urging Symptoms of the Scurvy; as, difficult Reſpiration, Scorbutical Collick, Fluxes, Giddineſs, Hemorrhagies, looſe and rotten Gums and Teeth, Pains in all the Limbs; beſides the Scorbutick Gout, Convulſions, Palſies, Atrophy, Feaver; as alſo Rheumatiſmes, Dropſies, and the Noiſe in the *Bones*, which ſome are troubled with in this Diſeaſe.

10. Of the *Vital* Indication, declaring, by what method and Medicines either the fainting Patient may be ſupported, or his decayed Forces reſtored: Where he diſcourſeth of Cardiacal Opiat Medicines, and of the Diet that is fit for Scorbutical perſons.

11. Some rare and very conſiderable Relations and Caſes of Scorbutick Men and Women.

II. ALPHABETUM NATURÆ, 1667. *Authore* F.M. B.V. HELMONT.

THis ſmall *Tract* (the Subject whereof ſeems to be New, not treated of hitherto by any we know of in Print) is publiſht both in the *Latin* and *German* Tongue, but came to our hands in the *latter* only; a *Latin* Copy, deſigned

deſigned for us before, having miſcarried at Sea, which we have not been able hitherto to get ſuppli'd, becauſe of the ſcarcity of the Copies of that Edition, as it was ſignified to us from *Amſterdam*.

It is divided into three parts: The *Firſt*, in Five Dialogues, treateth

1. Of the *Motions* and *Configurations* of the *Mouth* of Man; and how a Man, born deaf, and conſequently dumb, may come to underſtand both them, and by them the Mind of him that forms them: Where 'tis obſerved, that a Man born deaf is not altogether deſtitute of all Motion of his Tongue, and that he may be taught to underſtand others by the Motions of their Mouth and Tongue, much after the manner as others are taught to read; but that this is much more eaſily practicable in thoſe *wide-mouthed* Languages, which do remarkably expoſe to the Eye the Motions of the Tongue, Lips, Throat, *&c.* than in thoſe that are *narrow-mouthed*, and require but very ſlight Motions of the Lips and the other Organs of Speech. To which is annexed a Method ſutable to that principle, of teaching deaf and dumb Men to ſpeak; together with an Example of a *Muſician*, who being altogether deaf, and weak-ſighted withall, was by the Author brought ſo far in the ſpace of three weeks, that he was able to anſwer to all that was ſpoken to him, provided it were done ſlowly, and with a well-opened Mouth; who alſo afterwards by himſelf, as ſoon as he had by this very way learned to know the Letters, and to Read, did, by confronting only the *German* and *Hebrew* Bibles, learn in a ſhort time the *Hebrew* Tongue ſo well, that now he underſtands the whole *Hebrew* Bible.

2. Of the *Proprieties* of the *Hebrew* Tongue. How the Letters thereof are meer repreſentations of the Motions of the Mouth? How the *Hebrew Alphabet* may be deſcribed, (as 'tis done here) by repreſenting the Letters thereof in the *Mouths* of ſo many pictured Mens heads? How this *Alphabet* is to be compared with other ways of Writing? To which is added a Diſquiſition concerning the true ancient manner of Writing, and the original of other ways, and how the true way may be found out, and how much the Names of the Letters conduce thereunto?

3. Of the Nature and Properties of the *Tongue* of Man. Where *firſt* is conſidered the Speech of young Children, how and in what order *that* is made: *then*, the requiſiteneſs of the *Change* of *Tone* to Speech; and how by the various Openings of the Mouth and the Teeth, that change is cauſed. After which the Author proceeds to the deſcription of the *Tongue*, *Wind-pipe*, *Larynx*, *Epiglottis*; where he not only ſhews, how by a peculiar uſe of the *Epiglottis* one may come to ſpeak inwardly, as do the *Ventriloqui*, by attracting the Breath, and without Opening the Mouth; but annexeth alſo divers Rules concerning the Motions of the Tongue, obſerving eſpecially the perpetual concord of the Mouth and Tongue in their Motions, and the *Repreſentation* of the Tongue's Motion, requiſite for every Letter, in the Image and Figure of ſuch Letter.

4. Of

4. Of the *Breath* of Man, its quality, and its neceſſity for the forming of the Voyce. Where he ſhews, How by inſpiring, the Breath is diſtributed through the Lungs (the nature of which he alſo deſcribes;) and how the ſame circulates through the whole Body.

5. Of the *Animation* of the *Voyce* of Man by his Maſculine and *Generative* power. Where he diſcourſes of the difficulty, found in little Children, to pronounce certain Letters; and alſo of the Weakneſs of the Voyce in Children and Eunuchs. *So much of the firſt part.*

The *ſecond* part, in *one* Dialogue, gives an account, How the Motions and Configurations of the Mouth, and the Framing of the Voyce are reprefented in the *Hebrew Alphabet* (for, to this Tongue the *Author* confines himſelf; but with what reaſon, the Intelligent Reader of the Book it ſelf may judge:) explaining the *Sound* of each Letter, the *Motion* of the Tongue accompanying the Sound, and the *Figure* of the Letter, reſulting from thence; together with each Letters name, ſignification, and aptitude to form the next following Letter. Which done, he proceeds to ſhew, how the *Vowels* are formed by the *different Openings* of the *Mouth* and *Teeth*; ſo that to every Vowel belongs a peculiar dimenſion of Wideneſs in the Mouth: And according to the ſhape of the outward Mouth, the Tongue and Breath are conformably moved within. To which are added the *Names* of the *Vowels*, and their *Figures*; their abſence in moſt ancient Writings, and the ſeveral places in the Mouth for their formation. All which is concluded partly with a deduction of the Cauſe, why the *Hebrew* Tongue is written from the *Right* hand to the *Left?* partly, with an Explanation of the method uſed to compoſe out of ſuch Letters and Language a *Grammar*, *viz.* by comparing the *Conſonants* with one another, and the *Vowels* as well with one another as with the *Conſonants*; foraſmuch as the nature of one being well conſidered with reſpect to the other, 'tis not difficult to judge, how they agree or diſagree together: Whence *Rules* may be formed, how and why this or that Letter or Vowel is to be changed into another, *&c.*

The *Third* part treateth of the perfection of the *Hebrew* Tongue; wherein it conſiſts, and how highly 'tis to be valued, To which is ſubjoyned *firſt* a Diſquiſition of reaſon, why the *Radical* Words in the *Hebrew* Tongue can conſiſt of no more but three Conſonants? *Secondly*, a Diſcourſe touching the Hebrew *Accents*, ſhewing, that 'tis a *New* Invention, and that the *Ancient* Art of *Muſick* being loſt, and conſequently to us unknown, the *Modern* Hebrew Accents cannot reaſonably be ſaid to have been the *Muſical* Notes of the *Ancients*; ſince eſpecially all ſorts of *Hebrew* Books, and even their *Chapters* are marked therewith: though the *Author* acknowledges, that their newneſs deprives them not of the advantage of being uſeful.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be ſold at the *Bell* a little without *Temple-Bar*, 1667.

PHILOSOPHICAL TRANSACTIONS.

Monday, *February* 10. 166⅞.

The Contents.

Obſervations and Tryals about the Reſemblances *and* Differences *between a* Burning Coal, *and* Shining Wood. *An Obſervation concerning a* Blemiſh *in an* Horſes Eye, *not hitherto diſcover'd by any Author, which may be of great uſe in the choice of Horſes. An Extract of a Letter, written out of* Italy, *concerning divers* Spots, *not long ſince obſerved there in the Planet* Venus. *An extract of another Letter, printed at* Paris, *touching a late Cure of an inveterate* Phrenzy *by the* Tranſfuſion *of* Bloud. *An exact Narrative of an* Hermaphrodite, *now in* London. *An Account of ſome Books: I.* NOUVEAUX ELEMENS DE GEOMETRIE. *II.* SYNOPSIS OPTICA, *Authore* HONORATO FABRI, *Soc. Jeſu. III.* DE VI PERCUSSIONIS, JO. ALPHONS. BORELLI. *IV.* NICOLAI STENONIS MUSCULI *Deſcriptio* GEOMETRICA, *&c.*

Obſervations and Tryals About the Reſemblances *and* Differences *between a* Burning Coal *and* Shining Wood.

THeſe particulars were already in our hands, when we publiſht the Experiments made on Shining Wood *and* Fiſh, *in the laſt Papers, imparted then by the ſame Noble Author* (Mr. Boyle) *that thoſe were; but wanted then room enough to contain theſe, which now follow; as they were ſent in a Letter from* Oxford, *Viz.*

And now, *Sir*, seeing the want of *Shining Wood* hath kept me ever since I sent you the former Experiments from making any New ones on that subject, I shall, by way of amends, subjoyn some of the Observations, that I heretofore intimated to you, I had made of the *Resemblances* and *Differences* between a *Live Coal* and a Piece of *Shining Wood*; in perusing of which you will easily discern, that to those Particulars, which my Memory and the former Observations, I had noted down about *Light* and *Luminous Bodies*, had suggested to me, I have added some, that have been afforded me by those late Tryals, made in my Engine, whereof I sent you an account.

Resemblances.

The things, wherein I observed a piece of *Wood* and a *Burning Coal* to agree or resemble each other, are principally these Five.

1. *Both of them are* Luminaries, *that is, give Light, as having it (if I may so speak) residing in them, and not like* Looking-Glasses *or White Bodies, which are conspicuous onely by the incident beams of the Sun, or some other Luminous Body, which they reflect.*

This is evident, because both *Shining Wood* and a *Burning Coal*, shine the more vividly, by how much the place, wherein they are put, is made the darker by the careful exclusion of the adventitious light. 'Tis true, that the *Moon* and *Venus* appear brightest at or about Midnight, and yet have but a borrowed light; but the difference between those *Planets* and the Bodies we treat off, in reference to the difficulty we are considering, is obvious enough. For, though the Beholders eye that looks upon those Stars, be advantag'd by being in the dark, which enlarges the *Pupill* of the Eye, yet the Object it self is freely exposed to the beams of the *Sun*, which if they were intercepted, those *Planets* would quickly be darkned, as experience manifests in *Eclipses*.

2. *Both* Shining Wood *and a* Burning Coal, *need the presence of the Air, and are too of such a density, to make them continue shining.*

This has been prov'd as to a *Coal*, by what I long since publish'd in my *Physico Mechanical Experiments*, where I relate, How quickly

quickly a Coal would be extinguisht upon the with-drawing the Air from about it: And as to *Shining Wood*, the Experiments I lately sent you, make it needless for me to add any other proof of the requisiteness not only of Air, but of Air of such a thickness, to make its light continue. How far this is applicable to *Flame*, it is not necessary here to determine; though, when I have the satisfaction of seeing you again, I may tell you something about that *Question*, which perhaps you do not expect.

3. *Both* Shining Wood *and a* Burning Coal, *having been deprived for a time of their light, by the with-drawing of the contiguous Air, may presently recover it by letting in fresh Air upon them.*

The *former* part of this, particular Tryals have often shown you to be true, when kindled Coals, that seem to be extinguisht in our exhausted Receivers, were presently reviv'd, when the Air was restored to them: And the *latter* part is abundantly manifest by the Experiments, to which this Paper is an *Appendance.*

4. *Both a* quick Coal *and* Shining Wood *will be easily quencht by Water and many other liquors.*

The truth of this, as to *Coals*, is too obvious to need a proof; and therefore I shall confirm it only as to *Wood.* For which purpose you may be pleas'd to take the following Transcript of some of my *Notes* about Light.

I took a piece of *Shining Wood*, and having wetted it with a little Common Water in a clear Glass, it presently lost all its light *.

The like Experiment I tried with strong *Spirit* of *Salt*, and also with weak *Spirit* of *Sal Armoniack*; but in both the light did, upon the *Woods* inbibing of the liquor presently disappear.

* From hence you will easily ga her the reason; why, when I lately told you of the Trial, I made with a piece of *Shining Fish* under Water in the un-exhausted Receiver, I did not propose to have the like Trial made with *Shining Wood* and *Water*; but for *this* Liquor substituted *Mercury.*

And least you should think, that in the Words, *Many other liquors*, I intended not to comprise any, that consist of soft and unctuous parts, or that are highly inflamable, I shall subjoyn a couple of *Notes*, that I find next to those just now transcribed.

I made the like Tryal with rectified *Oyl* of *Turpentine*, with a not unlike ſucceſs. The ſame Experiment I tried more than once with high rectifi'd *Spirit* of *Wine*, which did immediately deſtroy all the light of the Wood, that was immerſed in it; and having put a little of that liquor with my finger upon a part of the whole piece of Wood, that ſhone very vigorouſly, it quickly did, as it were, quench the Coal as far as the liquor reach'd; nor did it in a pretty while regain its luminouſneſs: (which whether it recovered at all, I know not; for this Trial being made upon my Bed, I fel aſleep, before I had waited long enough to finiſh the Obſervation.)

5. *As a* quick Coal *is not to be extinguiſht by the Coldneſs of the Air, when that is greater than ordinary, ſo neither is a piece of* Shining Wood *to be deprived of its light by the ſame quality of Air.*

As much of this Obſervation, as concerns the *Coal*, will be readily granted, and for proof of the other part of it, I could relate to you more Trials, than one, but that I ſuppoſe, one may ſuffice, circumſtanc'd like that, which I ſhall now relate.

I took a ſmall piece of *Shining Wood*, and put it into a ſlender Glaſs-pipe, ſealed at one end, and open at the other, and placed this Pipe in a Glaſs Veſſel, where I cauſed to be put a ſtrongly frigorifick mixture of *Ice* and *Salt*, and having kept it there full as long, as I thought would be requiſite to freeze an Aqueous Body, I afterwards took it out, and perceived not any ſenſible Diminution of its light. But to be ſure, the frigorifick mixture ſhould not deceive me, I had placed by *this* Pipe another, almoſt filled with Water, which I found to be turn'd into *Ice*; and though I ſuffered the Wood to remain, a pretty while after, expoſed to ſo intenſe a Cold, yet when I took it out, it continued ſhining, and, if I much miſtake not, it ceaſed not to do ſo, when I lookt on it, 24. hours after. But though the light of *Shining Fiſh* be uſually (as far as I have obſerved) more vigorous and durable, than that of *Shining Wood*; yet I cannot ſay, that it will hold out againſt *Cold* ſo well, as the other. For, having ordered one of my ſervants to cut off a good large piece of the luminous *Whiting*, and bury it in *Ice* and *Salt*, when I call'd for it in leſs than half an hour after, I found it much ſtiffn'd

by

by the Cold, and to have no light, that I could discern in a place dark enough. And for fear, that this effect may have proceeded not barely from the operation of the *Cold*, but also from that of the *Salt* (for which suspicion you would see reason enough, if I could shew you my Trials about Shining *Fish*) I caused another time a piece of *Whiting* to be put in a Pipe of Glass seal'd at one end, and having seen it shine there, I lookt upon it again, after it had stayed but a quarter of an hour, by my estimate, in a frigorifick mixture, which the Glass kept from touching the Fish; and yet neither I, nor a Youth, that I employed to look on it, could perceive in a dark place, that it retain'd any light; which *whether* the Cold had deprived it of by that great change of Texture, that the Congelation of the Aqueous Juyce of the Fish (which I have several times observed to be luminous) may be supposed to have made in the Body invaded by it; *or* whether the effect depend more principally on some other cause, I shall not now examine.

Differences.

1. *The first difference I observed betwixt a* Live Coal *and* Shining Wood, *is, That, whereas the light of the former is readily extinguishable by Compression (as is obvious in the practice of suddenly extinguishing a piece of Coal by treading upon it) I could not find that such a Compression, as I could conveniently give, without losing sight of its operation, would put out or much injure the light ev'n of small fragments of Shining Wood:* One of my Trials about which I find thus set down among my *Notes* about Light.

I took a piece of *Shining Wood*, and having prest it between two pieces of clear Glass (whereof the one was pretty flat, and the other convex) so that I could clearly see the Wood through the Glass, I could not perceive, that the compression, though it sometimes broke the Wood into several fragments, did either destroy or considerably alter the Light.

This Experiment I repeated, with the same success. But, what

what a ſtronger or more laſting Compreſſion may do in this Caſe, I had not opportunity to try.

2. *The* next *unlikeneſs to be taken notice of betwixt* Rotten Wood *and a* Kindled Coal, *is*, *That the latter will in very few minutes be totally extinguiſht by the with-drawing of the Air, whereas a piece of* Shining Wood, *being eclipſed by the abſence of the Air, and kept ſo for a time, will immediately recover its Light, if the Air be let in upon it again within half an hour after it was firſt with-drawn.*

The *former* part of this Obſervation is eaſily proved by the Experiments, that have been often made upon *Quick Coals* in the *Pneumatical Engine*; and the truth of the *latter* part appears by an Experiment about *Shining Wood* made by us in *October* laſt. Neither is it unprobable, that if I had had conveniency to try it, I ſhould have found, that a piece of *Shining Wood* deprived of its light by the removal of the ambient Air, would retain a diſpoſition to recover it upon the return of the Air, not onely for half an *hour* (which is all that I lately aſſerted) but for half a *day*, and perhaps a longer time.

3. *The* next *difference to be mention'd is*, *that a* Live Coal *being put into a ſmall-cloſe-Glaſs, will not continue to burn for very many minutes; but a piece of* Shining Wood *will continue to ſhine for ſome whole dayes.*

The *firſt* part of the Aſſertion I know you will readily grant, and the rather, becauſe it contains matter of fact, without at all determining, whether the Coals not continuing to burn, proceeds from its being, as it were, ſtifled by its own ſmoak and exhalations (which can have no vent in a ſmall-cloſe-Glaſs) or from the want of freſh Air, or from any particular cauſe, which I muſt not here debate; though I have ſometimes made Experiments ſomewhat odd to facilitate that enquiry. The *other* part of our Obſervation may be eaſily made out by what I tried upon *Shining Wood*, ſealed up Hermetically in very ſmall Glaſſes, where the Wood did for ſeveral dayes (though I remember not preciſely how many) retain its Light.

4. *A* fourth *Difference may be this*; *That*, *whereas a* Coal, *as it burns*, *ſends forth ſtore of ſmoke or exhalations*; Luminous Wood *does not ſo.*

5. *A* fifth, *flowing from the former*, *is*, *That*, *whereas a* Coal *in ſhining waſtes it ſelf at a great rate*, Shining Wood *does not.*

Theſe two unlikeneſſes I mention together, not onely becauſe of their affinity; but becauſe what concerns the *Coal* in both, will need no proof; and as for what concerns *Rotten Wood*, it may be verified by an Obſervation, that I find by my *Notes* I made in a piece of it Hermetically ſealed up in a ſmall clear Glaſs; where after it had continued luminous ſome dayes, I lookt on it in the day time to perceive, if any ſtore of ſpirits or other ſteams had, during all that while, exhaled from the Wood, but could not find any on the inſide of the Glaſs, ſave that in one place there appeared a kind of *Dew*, but conſiſting of ſuch very ſmall drops (if at leaſt their Size were not below that name) that a multitude of them would go to the making up of one ordinary drop. But in pieces of *Shining Fiſh* I found the caſe much otherwiſe, as was to be expected.

6. *The* laſt *Difference*, *I ſhall take notice of betwixt the Bodies hitherto compared*, *is*, *That a* Quick Coal *is actually and vehemently hot*; *whereas I have not obſerved* Shining Wood *to be ſo much as ſenſibly luke-warm.*

What is ſaid of the *Coals* heat, being as manifeſt as its light, I ſhall need only to make out, what relates to the *Shining Wood.* To aſſiſt me wherein, I meet among my *Notes* that, whoſe tranſcript I ſhall ſubjoyn, when I have premis'd, that (if my memory do not deceive me) the piece of Wood to be mentioned was one, that ſhone ſo vividly, that waking in the Night ſome hours before I tryed it, and perceiving, as it lay near me on the Bed, how luminous it was, I was invited to reach out to a place near the Beds-head, where there ſtood ſeveral Books, and laying the Wood on that, which came to hand, I could diſcern by the light of it, that the Book was an Hebrew Bible, and that of the Page, I lighted on, the wrong end was turn'd upwards: To which intima-

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tion having added, that the little Glaſs-Inſtrument, mention'd in the *Note*, is ſuch an one, as you may find deſcribed in my *Preliminaries* to the *Hiſtory of Cold*, ſave that part of this was a little bending inward at the *Baſis*, that it may ſometimes ſtand by *it ſelf*, and ſometimes receive a ſmall body into the *dimple* at its *Baſis*: Having, I ſay, premiſed this, and, that as *Shining Wood* did not feel at all warm to me, ſo I alſo found *Shining Fiſh* palpably cold, I ſhall conclude your trouble with the premiſed *Note*, which ſpeaks thus:

[I put upon a large piece of Wood, which was partly ſhining, and, as near as I could, upon one of the moſt luminous parts of it, one of thoſe *Thermoſcopes*, that I make with a pendulous drop of Water. But as I had formerly try'd, that by laying the tip of my Noſe or Finger upon it, when it ſhone vividly enough, to enable me to diſcern both the one and the other, at the time of contact I could not perceive the leaſt of heat, but rather an actual coldneſs; ſo by this Trial I could not ſatisfie my ſelf, that it did viſibly raiſe the pendulous drop; though the Inſtrument were ſo tender, that by approaching one Finger near it, yet without actually touching of it, it would manifeſtly be impelled up, and upon the removal of my Finger, would preſently deſcend again.]

And I remember, that having put ſuch an Inſtrument upon a *Shining Fiſh*, that was pretty large, I could not thereby perceive, that it had any degree of heat, but rather the contrary. For, having divers times taken off the Glaſs, to apply it with the more advantage to ſeveral parts of the *Luminous Fiſh*, I divers times (for I remember not, whether 'twere alwayes) took notice, that upon the removal of the Glaſs into the Air, the pendulous drop would manifeſtly riſe a little, and ſubſide again when the Glaſs was applied to the Fiſh. But whether this part of the Experiment will hold in all temperatures of the Air, I had not opportunity to try.

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An Obſervation

Concerning a Blemiſh *in an* Horſes Eye, *not hitherto diſcover'd by any Author; which may be of great uſe in the Choice of an Horſe to thoſe who are Curious; made by Dr.* Richard Lower *at the* Royal Society, January 23. 166$\frac{7}{8}$.

AMong the many defects and diſtempers in the Eyes, the Eyes of Horſes are peculiarly affected with one, which no Animal beſides is troubled withall (as far as I have obſerv'd) neither do I remember any Author hitherto to have taken notice of it; and that is a *Spungy Excreſcence* (commonly of a dark muskecolour) which grows out of the edge of that Coat of the Eye call'd the *Uvea*; which Spunge if it grow large or increaſe in number (as it frequently happens) it depraves the ſight very much, or totally intercepts it. But that you may more eaſily conceive the manner, how it is done, you may remember, that the *Uvea* is a *muſculous* part, the uſe of it being chiefly to contract and dilate it ſelf for the admiſſion of Objects with as much light, as the Eye can conveniently bear; ſo that, the brighter and more refulgent the light is, to which the Eye is expos'd, that Membrane contracts its ſelf into a narrower compaſſe; and the more dark the place is, it delates it ſelf the more, as you may ſee in a *Cats* eye more readily perform'd, than in any other *animal*, I have yet obſerv'd: So that, if that *ſpungy* ſubſtance, which growes out of the edge of the *Uvea*, be ſo great, or the number of them ſuch, as that they grow in ſeveral places about the *pupill* of the Eye, where it contracts its ſelf, the *pupill* or ſight is very much (if not totally) obſtructed, and conſequently the Horſe ſees very little or nothing at all: As I have many times taken exact notice in ſome Horſes, which being brought into the Sun-ſhine, could not ſee at all, but ſuffer'd me to touch the *ſight* of their Eye with my finger without the leaſt winking; which Horſes being led back into the Stable, the *Uvea* in that obſcure place dilating it ſelf, they could ſee very well again, and would not ſuffer me to ſhew my finger near to the Eye without frequent cloſing their Eye-lids and toſſing their heads. The ſame Horſes I underſtood by the

Owners were very apt to ſtumble in the day-time, if it were bright and Sun-ſhine, but trave l'd very well and ſecurely in the evening and in dark cloudy Weather.

What the *cauſe* may be of that fungous Excreſſence, or why Horſes are peculiarly obnoxious to it, or what kind of Horſes moſt, I have not conſidered. But, I cannot think, it comes from ſtraining in great draughts, and races, or from hard travel, becauſe I have ſeen very large *Spunges* (as I may call them) in young Horſes eyes of 2 and 4 years old, before they were backed; which, after they have been taken up from graſſe, and kept with dry meat, have very much abated, and afterwards being turn'd to graſſe in the Spring to cleanſe and cool their bodies, have increaſed again to the wonted bigneſs. But whether it were from their moiſt feeding, or holding down their heads to eat (whereby there might be a greater defluxe of humors to that part) I cannot determine. But for as much as there are few Horſes quite free from this evil, and many rendred very inconſiderable by it, I will recount the moſt remarkable Caſes, which make Horſes moſt uſeleſs and ſuſpected;

1. The more and greater thoſe *Excreſcences* are, the more the *pupill* of the Eye or the Sight is in danger of being quite obſtructed; which you may farther examine by turning the Horſes Eye to the light, and obſerving, how much of the *pupill* they doe obſtruct.

2. Theſe *Spunges* on the upper edge of the *Uvea* are apt to grow the largeſt, and hinder the Sight moſt.

3. That which grows on the middle of the *Uvea*, does more hinder the ſight by diſtracting the Object, than that, which grows in either Corner or angle of it.

As for the *Cure*, I ſuppoſe there can be none exſpected, but from a drying kind of dyet; though perhaps outwardly ſomething may be deviſed to ſhadow the Eyes, and keep them from being nakedly expoſed to the Sun, whereby the *pupill* will not be ſo cloſely contracted, and conſequently the Sight not ſo much obſtructed.

An Extract

of a Letter written by Signor Caſſini *Profeſſor of Aſtronomy in* Bononia, *to Monſieur* Petit *at* Paris, *and Engliſhed out of the* Journal Des Scavans; *concerning ſeverall* Spots, *lately diſcover'd there in the Planet* Venus.

TO give you ſome Account of my preſent Studies, I ſhall acquaint you, that having been a good while very aſſiduous and carefull in making Obſervations of *Venus*, to ſee, whether that Planet did not turn about its Axis, by a motion like to that of *Jupiter* and *Mars*; I met at firſt with many difficulties; but at laſt conſidering, that I ſhould ſucceed better in my Obſervations at a time, when *Venus* is at a good diſtance from the *Earth*, than when ſhe is near thereto, I attentively obſerv'd, when ſhe was riſen ſomewhat high above the *Horizon*, and ſhined brighter, whether I could not diſcern in Her ſome part remarkable either by its brightneſs or obſcurity, among the reſt, eſpecially about the middle of her Diske. And this I did not in vaine; for, I diſcover'd at laſt towards the middle of her Body a part clearer than the reſt, by which one might judge of the Motion or the Reſt of this Planet.

The firſt time I ſaw it, was *Octob.* 14. 1666. h. 5. 45′. p. m. and then this bright part was very near the Center, on the *North-ſide*. And at the ſame time I obſerved *Weſt-ward* two *obſcure* ſpots, ſomewhat oblong. But I could not then ſee that reſplendent part long enough, to conclude any thing from thence; nor was I able to ſee any thing well of thoſe parts till *April* 28. 1667; on which day, a quarter of an hour before Sun-riſing I ſaw again a *bright* part, ſcituated near the *Section*, and diſtant from the *Southern Horn* a little more than $\frac{1}{4}$ of its Diameter. And near the *Eaſtern Ring* I ſaw a dark and ſomewhat oblong ſpot, which was nearer to the *Northern* than the *Southern* Horn. At the riſing of the Sun I perceived, that this *bright* part was then no more ſo near the *Southern* Horn, but diſtant from it $\frac{1}{3}$ of its Diameter. This gave me great ſatisfaction. But

I was ſurpriſed at the ſame time to find, that the ſame Motion, which was made from *South* to *North* in the inferior part of the Diske, was on the contrary made from *North* to *South* in the ſuperior part; whence the determination of the Motion may be better taken. For we have no example of the like motion, except it be in that of the *Libration* of the Moon.

The next day, at the riſing of the Sun, the ſaid *bright* part was not far from the *Section*, and diſtant from the *Southern* Horn $\frac{1}{4}$ of the Diameter. When the Sun was 4. deg. high, the ſame was ſcituated near the *Section*, and remote from the *Southern* Horn $\frac{2}{5}$ of the Diameter. The Sun being high 6.d. 10′. it ſeem'd to have beenpaſſed the Center, and that the Section of the Disk did cut the ſame. The Sun being 7. deg. high, it appeared yet more advanced North-ward, together with two *Obſcure* Spots, ſeated between the *Section* and the *Circumference*, and equally diſtant from one another, and from each Horn on both ſides. And the Sky being very clear, I obſerv'd the motion of the *bright* part for $1\frac{1}{8}$ houre; which then ſeem'd to be exactly made from *South* to *North*, without any ſenſible Inclination *Eaſt*-or *Weſt-ward*. Mean-time I perceiv'd in the motion of the *dark* Spots ſo great a Variation, that it cannot be adſcribed to any reaſon in *Opticks*.

May 10. and 13. before Sun-riſing, I ſaw ſtill the *bright* part near the Center *North-ward*.

Laſtly, *June* 5. and 6. before the riſing of the Sun, I ſaw the ſame between the *Northern-Horn* and the Center of this Planet, and I noted the ſame irregular Variation in the *obſcure* Spots. But when *Venus* began to be further remov'd from the Earth, it was more difficult to obſerve theſe *Phænomena*.

I ſhall not preſume to declare my ſentiment touching theſe Apparances ſo boldly, as *I* did concerning the Spots formerly diſcover'd in *Jupiter* and *Mars*. For thoſe ſpots *I* could very well obſerve for a whole night together, during the oppoſition of thoſe Planets to the Sun: *I* could conſider their Motion for the ſpace of ſeverall hours; and at laſt, ſeeing them return regularly to the ſame place, *I* could judge, whether they were the ſame ſpots or not, and in how much time they

they abſolv'd their Relation. But it was not ſo here with the Apparences in *Venus*. For one ſees them but for ſo ſmall a time, that it is far more difficult, *certainly* to know, when they return to the ſame place.

Yet this I can ſay, (ſuppoſing that this *bright* part of *Venus*, which I have obſerv'd, eſpecially this year 1667, hath alwayes been the ſame) that in leſs than one day it abſolves its motion, whether of *Revolution* or *Libration*, ſo as in near 23 hours it returns about the ſame hour to the ſame ſcituation in this Planet; which yet happens not without ſome irregularity. Now to affirm, (ſuppoſing it to be alwayes the *ſame* bright part) whether this Motion is made by an entire *Revolution*, or by a *Libration*, I dare not yet doe, in regard I could not ſee the Continuity of the Motion through a *great* part of the Arch, as I did in the other Planets. And for this very reaſon, *that* will alwayes be difficult to determine.

An Extract.

Of a Letter, written by J. DENIS, *Doctor of Phyſick, and Profeſſor of Philoſophy and the Mathematicks at* Paris, *touching a late* Cure of an Inveterate Phrenſy *by the* Transfuſion of Bloud.

This Letter was lately ſent by the Auth r himſelf to the Publiſher, *as it was printed at* Paris *in* French; *the ſubſtance whereof is in* Engliſh, *as followes.*

IT is now almoſt a twelve-month that I declared my ſelf publickly in this matter of *Transfuſion*, and after I had grounded my Conjectures upon divers reaſons, and a number of Experiments which I made joyntly with *M. Emmerez*, I reſolv'd to expect in the ſequel a further confirmation, by carefully obſerving all that ſhould happen in the ſeverall Trialls, I intended to practiſe.

In this reſolution we have ſince let ſlip no occaſion, to improve this Operation, which hath been follow'd with good ſucceſs, and I could here alledge ſome particular Relations, the circumſtances of which would appear curious enough, if I did not

not rather chooſe to referr them to a Collection, which poſſibly I may ſend you within ſome time, to have the more room to enlarge in this Letter on the circumſtances of a Story, whereof you will be very glad to learn the Event.

You have doubtleſs heard of a *Mad* man, that hath been lately cured, and reſtored to his wits by the means of the Transfuſion. Some ſpred a rumour that he died ſoon after the operation; others bore the people in hand, that he was relapſed into a greater madneſs, than that before, and in ſhort, it hath been ſo diverſly diſcourſed of up and down, and with ſuch differing reflexions thereon, that I thought my ſelf obliged, for the clearing up of what falſe rumours had darkned, to give you a faithfull and exact account of the condition, to which this poor Man was reduced before the Transfuſion; of what paſſed during that Operation, and the ſurpriſing effects, that have followed upon it hitherto.

The Patient is about 34 years of age. His Phrenſy began firſt of all to appear 7 or 8 years agoe, and as far as can be judged, it was occaſion'd by a diſgrace he received a little before, in ſome Amours, where he hoped to find a very conſiderable fortune. This firſt fit of extravagance was very violent, and laſted 10. months without any good intervall: but returning afterward by little and little to his wits, and having given all the poſſible marks of a ſound underſtanding, he was married to a young Gentlewoman, who was perſwaded, that this madneſs of his was the relick of a Sickneſs he had before, and that there was no appearance he would ever relapſe into it. But this was far from proving ſo, as was imagined, and even the very firſt year of his marriage ended not without his returning to his former Extravagancies.

Thus then he relapſed, and was ſeveral times reſtored theſe 7 or 8 years laſt paſt. But what is here chiefly to be obſerved, is, that the fit never laſted with him leſs than 8 or 10 moneths, without any reſpit, notwithſtanding all the care and means uſed to relieve him. For it is alſo fit to take notice, that a perſon of quality, having once taken a purpoſe to attempt his Cure by all manner of wayes, cauſed him to be bled in his feet, armes, and head, even 18 times, and made him bath himſelf 40 times,

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not to mention innumerable applications to his fore-head, and potions. But instead of amendment, the distemper seem'd to be provoked by those remedies, and this poor creature fell into that rage, that there was a necessity to bind him up from doing mischief. His Madness hath been alwayes *periodicall*, and never abated but by little and little, and that abatement hath befalne him rather at such times, when nothing was done to him, than when he was tormented with medicins.

The last time, that he relapsed into his Extravagancy, was about 4 moneths since, in a place 12 leagues distant from *Paris*. And his Wife hearing of it, went immediately to him to relieve him. She soon shut him up, and was even constrained to tye him for some time, because he was in such an extraordinary rage as to beat her. But for all her care, one time he got loose stark naked, and ran away streight for *Paris*, no body knowing, how he could find his way in the dark night. His Wife had him searched for in all the neighbouring Villages, whilst he ran here in *Paris* up and down the streets, without finding any place to retire to, in regard that those, who had the charity of receiving him into their houses the first dayes, knew very well the danger they were in, of having their houses burnt over their heads.

He was not less outragious in this last fit, than in the former. He hath spent 3 or 4 months without sleep, and his greatest divertisement during that time was, to tear the Cloaths, that were given him, to run naked abroad, and to burn in the houses where he was, whatever he could meet with. He moved to compassion all good people, that saw him, and especially those in the *Marais du Temple*, where he was known to most, and where he had been wont to be seen before this distemper as well cloathed and fashion'd, as any one of his condition could be.

Monsieur de *Montmor* among others was the person most touched with it, and resolved to employ his interest to procure him a place in one of the Hospitals. But first he thought on the Transfusion, and believed, there would be no danger in trying it upon this Man, being so perswaded by many Experiments, we had already made in his presence. He therefore had been taken up for that end, and having sent for Me and M. *Emmerez* to ask

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our opinion of the fitneſs of trying the Transfuſion upon this man, we anſwer'd, that we could indeed give good aſſurance for his Life, and that this Operation was in it ſelf not capable to cauſe the death of any one, if diſcreetly managed; but as to the Cure of ſuch an Extravagance, as that appeared to us, we had not yet experience enough to dare to promiſe him *that*, and that our Conjectures went no farther, than to think, that the Bloud of a Calf by its mildneſs and freſhneſs might poſſibly allay the heat and ebullition of his Bloud, being mixed therewith. The matter having been ſufficiently examined, we reſolv'd to carry this Man into a private houſe; and there we appointed for his Gardian that Porter, on whom we had already practiſed the Transfuſion, 8 months agoe, both that the Thing might not appear ſo new to him, as it might do to others, that never had ſeen the Experiment before, and that he might ſerve us the more to aſſure our Patient, and others, who ſhould be preſent at the Operation, that there was no danger in it at all.

Decemb. 19. we uſed what art we could to diſpoſe the Fancy of our Patient to ſuffer the Transfuſion, which we reſolv'd ſhould be tryed upon him that night about 6 a clock. Many perſons of quality were preſent, together with ſeveral Phyſitians, and Chirurgions, too intelligent to ſuſpect them of being capable of the leaſt ſurpriſe. Mr. *Emmerez* open'd the *Crural Artery* of a *Calf*, and did all the neceſſary preparations in their preſence; and after he had drawn from the Patient about 10 ounces of bloud out of a Vein of the right Arm, we could give him no more again than about 5 or 6 ounces of that of the Calf, by reaſon that his conſtrained poſture, and the crowd of the Spectators interrupted very much this Operation.

Mean time he found himſelf, as he ſaid, very hot all along his Arm, and vnder the Armpits; and perceiving, that he was falling into a ſwoon, we preſently ſtopped the bloud running in, and cloſed up the wound. Yet he ſupped two hours after, and notwithſtanding ſome dulneſs and ſleepineſs, he was in now and then, he yet paſſed that night with ſinging, whiſtling, and other extravagancies uſual with him.

But yet next morning we found him ſomewhat leſs exorbitant, both in his actions and words; and that induced us to believe, that

that by reiterating the Transfuſion once or twice, we might find a more remarkable change in him. We therefore prepar'd our ſelves to repeat it upon him the next *Wedneſday* at ſix a Clock in the evening again, in the preſence alſo of ſeveral very able Phyſicians, *Bourdelot*, *Lallier*, *Dodar*, *de Bourges*, and *Vaillant*. But in regard that this man appear'd very thin, and that it was not at all probable, that his blood was peccant in the quantity after three or four months continual watching, and after the hunger and cold he had ſuffered in running naked on the Streets without finding harbour at nights, we took but two or three ounces of blood from him, and having put him in a more convenient poſture, we made this ſecond Transfuſion into his left arm more plentiful then the firſt. For conſidering the bloud remaining in the Calf after the operation, the Patient muſt have received more then one whole pound.

As this ſecond Transfuſion was larger, ſo were the effects of it quicker and more conſiderable. As ſoon as the blood began to enter into his veins, he felt the like heat along his Arm and under his Arm-pits which he had felt before. His pulſe roſe preſently, and ſoon after we obſerved a plentiful ſweat over all his face. His pulſe varied extreamly at this inſtant, and he complain'd of great pains in his Kidneys, and that he was not well in his ſtomack, and that he was ready to choak unleſs they gave him his liberty.

Preſently the Pipe was taken out that conveyed the blood into his veins, and whilſt we were cloſing the wound, he vomitted ſtore of Bacon and Fat he had eaten half an hour before. He found himſelf urged to Urine, and asked to go to ſtooll. He was ſoon made to lie down, and after two good hours ſtrainings to void divers liquors, which diſturbed his ſtomack, he fell aſleep about 10 a Clock, and ſlept all that night without awakening till next morning, was *Thurſday*, about 8 a Clock. When he awakened, he ſhewed a ſurpriſing calmneſs, and a great preſence of mind, in expreſſing all the pains, and a general laſſitude he felt in all his limbs. He made a great glaſs full of Urine, of a colour as black, as if it had been mixed with the ſoot of Chimneys.

Hearing of ſome of the company that we were in a time of Jubily, he asked for a Confeſſor, to diſpoſe himſelf to be made participant of it. And he confeſſed himſelf accordingly to M. *de Vean* with that exactneſs, that the Confeſſor gave him the publick teſtimony of a ſound underſtanding, and even judged him capable to receive the Sacrament, if he continued in that ſtate and devotion.

He remained ſleepy all the reſt of that day, ſpake little, and prayed thoſe that came to importune him with interrogatories, to give him reſt. And he went on to ſleep well alſo the whole night following. *Friday* morning he filled another Urinal with his water, almoſt as black as that of the day

before. He bled at the Noſe very plentifully, and therefore we thought it proper to take 2 or 3 ſmall Porringers of blood from him.

Saturday morning, the laſt day before *Chriſtmas*, he deſired ag ain to go to confeſs, and ſo to diſpoſe himſelf for the Communion. Then one Mr. *Bonnet* examined him in hearing him confeſs, and after he had found him to have all the reaſon neceſſary to receive the Sacrament, he preſently gave him the Communion. That ſame day his Urine clear'd up, and after that time it reſumed by little and little its natural colour.

His Wife mean time, that had ſought him from town to town, came to *Paris*, and having found him out, when he ſaw her, he ſoon expreſſed much joy to ſee her, and related to her with great preſence of mind the ſeveral Accidents that had befallen him, running up and down ſtreets; how the Watch had ſeized on him one night, and how Calfs-blood had been transfuſed into his veins.

This Woman confirmed yet more to us the good effects of the Transfuſion, by aſſuring us, that at the ſeaſon we were now in, her Husband ſhould be outragious, and very mad againſt her ſelf, and that inſtead of the kindneſs he ſhewed to her at this *Full* of the *Moon*, he uſed to do nothing but ſwear, and beat her.

'Tis true, that comparing his calm condition, wherein he now was, with that, wherein every body had ſeen him before the *Tranſfuſion*, no man ſcrupled to ſay that he was perfectly recover'd. Yet to ſpeak the plain truth, I was not ſo well ſatisfied as others ſeem'd to be, and I could not perſwade my ſelf that he was in ſo good a temper as to ſtop there, but I was inclin'd to believe by ſome things I ſaw, that a third Transfuſion might be requiſite to accompliſh what the two former had begun.

Yet in delaying the execution of theſe thoughts from day to day, we obſerved ſo great an amendment in his carriage, and his mind ſo clear'd up by little and little, that his wife and all his friends having aſſur'd us that he was reſtored to the ſame ſtate he uſed to be in before his Phrenzy, we entirely quitted that reſolution. I have ſeen him almoſt every day ſince; he hath expreſſed to me all manner of acknowledgment, and been alſo with M. *de Montmor*, thanking him very civily for his goodneſs in recovering him out of that miſerable condition he was in by a remedy which he ſhould remember as long as he lived.

He is at preſent of a very calm ſpirit, performs all his functions very well, and ſleeps all night long without interruption, though he ſaith he hath now and then troubleſome dreams. He hath carried himſelf ſo diſcreetly in ſome viſits he made this week, that divers Phyſitians, and other perſons worthy of credit, that have ſeen him, can render an authentick teſtimony to all the circumſtances here advanced by me, who ſhall not employ againſt cavils and contradictions any other arguments than the experiment it ſelf.

The

The laſt year I publiſhed my Conjectures and my Reaſons. Of all thoſe that have undertaken to combate them, there is not one that hath ſo much as touched the ſtate of the Queſtion. And this hath made me ſilent to them all. I have confined my ſelf to the experiments alone; this, whereof I now ſend you the particulars, will perhaps open the eyes to ſome that are opiniatre. I would not relate the ſtory but very plainly, without embaraſſing it by any ratiocinations; not but that there was good matter to diſcourſe upon, both during the time of the Transfuſion, and after it. Some believed, that the vomiting came from the eating much Bacon, half an hour before the operation: Others, conſidering the pain in his Kidneys during the Transfuſion, and the ſwelling of his Stomack, which was preſently followed by evacuations above and below, do believe, that the new blood, entring in great quantity, cauſed a plenitude, and a fermentation in the great veſſels, which could not but be followed by all thoſe effects. To which may be added, that almoſt all thoſe, into whoſe veins other liquors then bloud have been *injected*, have found the ſame Accidents.

It is alſo not yet agreed on, what was the cauſe of the laſſitude, that obliged this man to keep his bed for ſome whole dayes: Some ſay, it proceeded from the diſorder conſequent to the entry of new blood into his veins. Others have look'd upon it as the effect of a kind of *Rhumatiſme* he had got, lying ſtark naked in the ſtreets; and have thought that he became not ſenſible of thoſe pains, but after the recovery of his reaſon, juſt as thoſe that have a hot Feaver do never complain of wearineſs, but after the abatement of the Fitt.

There hath alſo been very differing Diſcourſe of that *black* colour in his Urine ſome dayes after the Transfuſion; ſome alledging, that it was cauſed by ſome veins, which having been opened from too great a fulneſs, diſcharged themſelves into the Kidneys and Bladder: others, believing that it was a black choler, diſcharging it ſelf by the veins, and which being retain'd before, ſent up vapours to the Brain capable to trouble the functions thereof.

I ſhall here ſuſpend my judgment, reſolved not to declare my thoughts, till I have made many experiments more, For I know very well, that in 50, we have made upon Brutes, we have found it but twice that the Recipient animal piſſed bloud after it, and as far as I can judge, I believe I have infallible wayes of preventing all ſuch diſorders; and I have propoſed to my ſelf a manner of preparation aud treatment, which the Patient may be made to obſerve both before and during the operation, to render it more beneficial. For 'tis not to be doubted, but meaſures are to be taken to diſpoſe the body for Transfuſion, as well as for all other operations to be undertaken with ſucceſs. But we need not repent for not having obſerved them in this caſe; it appeared much better what the Transfuſion all alone

could do, and no cauſe hath been given to prejudiced men to impute this cure to the *Preparation* rather, then to the *Operation* it ſelf.

We hear of many other ſick perſons, who poſſibly may find relief from this Experiment. I ſhall not fail to let you know the ſucceſs of it in good time.

An Exact Narrative
Of an Hermaphrodite *now in* London.

This was communicated by the ingenious Dr. *Tho. Allen* (now a Fellow of the R. *Society*) to a friend of his in a *Latine* Letter, in which as it was imparted to the ſaid *Society*, ſo it was thought fit to publiſh it here for the view of the Learned; *viz.*

INter varios inſolenteſq; Naturæ luſus, dicam? an errores, quos apud eos, qui de Androgynis *egerunt (quorum ſcripta ſedulo deditaq; opera perluſtravi) in lucem productos adhuc videre mihi contigit, vix alium quenquam notatu digniorem memini occurrere hoc ipſo, quem tibi, Erudite Vir, impræſentiarum exhibeo. Neq; enim hunc, quem jam deſcriptum eo,* Hermaphroditum, *aut ſpurciſſimis illis fœminis, quæ apud* Græcos Τειβάδες *audiunt, apud* Ægyptios *vero frequentiſſime reperiebantur, annumerandum, aut cum deſcriptione quacunq; hactenus quod ſciam evulgata, ullatenus quadrare exiſtimo. Unde nec prorſus indignus mihi videtur, qui nativis depictus coloribus, abſque omni verborum fuco, Illuſtriſſimæ Lectiſſimæque* Regiæ Societatis *& tuis oculis uſurpandus veniat.*

Nomen ipſi eſt Anna Wilde; *natus vero eſt (condonandus enim* Hermaphrodito *ſolœciſmus) Menſe* Februario, *ipſo Purificationis feſto, Anno ſalutis,* 1647. *in pago non ignobili Agri* Hamptonienſis, *vulgo* Ringwood. *Sexto ætatis anno inter ſaltandum colluctandumq; cum pueris coætaneis (quos omnes viribus facile ſuperabat) extuberationes duæ,* Herniarum Βεβωνοκηλῶν *dictarum, primum emicuere; quibus in ordinem redigendis (id enim illis animi erat) Chirurgi diu operam luſerunt. Teſticuli enim erant, qui jam prægrandes facti, ſcrotis cutaneis, corrugatis, piliſq; obſitis incluſi, non alio diſcrimine a Virilibus naturaliter ſe habentibus diſtinguuntur, quam quod ſinguli teſtes ſuo proprio diviſoq; ab invicem hic ſcroto gaudeant, ita tamen elongato, ut ex utriuſq; productione confingantur labia Vulvæ.*

In ſinu Muliebri (ut jam a Mercurio *ad* Venerem *tranſeamus)* Nymphæ *&* Carunculæ Myrtiformes, *integræ ſatis ſe produnt: Quin & membranula quadam, a* Perinæo *ſurſum tendente, media pars Vulvæ tegitur.* Clitoris *non apparet. Uterus ejuſq; cervix a communi ſequioris ſexus lege ne minimum quidem recedunt. Uſq; ad tertium ſupra decimum ætatis annum pro fœmella habitus, & fœmineo veſtitu indutus, munera illi ſexui deſtinata inter fœminas aſſidue obibat. Cum forte vero pani ſubigendo ſtrenuam navaret operam, en*

derepente

derepente Priapus, ad id temporis latens, magno cum impetu foras prorupit, accedente non levi ipsius Μεταμορφομένης *stupore. Erectus penis quatuor circiter pollices æquat. Locum Virgæ virilis ipsissimum occupat; in glandem pariter desinit; præputio, quod illi etiam frænulo, ut in Viris fit, annectitur, instructum: sed Glans imperforata (ita tamen ut tenuis membranula eam obturans facile pertundi posse videatur) semini, per* Urethram, *seu potius Virgæ canaliculum viam affectanti, exitum negat; unde per pudendum muliebre (refluum forte) excernitur.*

Cum annorum esset sedecim, Menstrua periodice & modo debito fluere cæperunt, atque per biennium perseveraverunt. Quo elapso, iisdem non amplius comparentibus pullulavit Barba, & exinde totum corpus pilosum conspicitur; Vox corporisq; habitus virilem amulantur. Crinis se habet virorum ad instar. Mammæ nullæ exsurgunt: papillæ perquam exiguæ. Pectus latum est. Ischia non ita dissita. Nates quam sunt fœminarum contractiores.

Se ad utrumque sexum comparatum asserit, sed fœminis misceri præoptare; quas etiam cum videt, & concupiscit, erigitur Penis, qui quoties Virum appetit, flaccidus manet.

Unum hoc, idque nec extra oleas putem, Coronidis loco subnectam; Quod nempe, cum nocte quadam, quam totam tripudiis, compotationibus, cæterisq; id genus lascivia incitamentis, cum aliquot ejusdem farinæ congerronibus insumpserat, oculos in virum quendam formæ venustioris conjecerat, mox eum adeo deperibat, ut sequenti die, præ amoris æstro, in passionem hystericam incideret; quam revera talem fuisse, non solum Elevatio abdominis, Cantus, Risus, Fletus, (notissima illius intemperiei symptomata) sed & juvantia, satis liquido comprobarunt: Applicato quippe Emplastro ex Galbano *regioni Umbilici, exhibitisq; remediis hystericis ilico convaluit.*

An Account of some Books.

I. NOUVEAUX ELEMENS DE GEOMETRIE:

Or a Mathematical Treatise, entituled, *New Elements of Geometry*, printed at *Paris* in quarto, *Anno* 1667.

Divided into 15 Books or Sections, containing

A New Method and Order, and new Demonstrations of the most common Propositions in Geometry,

New ways to discover what Lines are incommensurable.

New measures of Angels not hitherto considered.

New wayes of finding out, and demonstrating the Proportion of Lines.

Wherein we observe, that the Author delivers by a new Method and Order of his own, grounded upon *Algebraical Elements*, divers new Demonstrations

monſtrations of the more common Propoſitions, contained chiefly in the firſt ſix Books of *Euclids* Elements, and without recourſe to *Euclid*, or any other Geometrical Writer for proof of any thing aſſerted in thoſe new Elements.

Whereto is added the ſolution of an *Arithmetical Probleme*, which the Author calls *Magick Squares*, viz.

A ſquare of Cells being given, even or odd, filled with Numbers, either in an Arithmetical *or* Geometrical *Progreſſion; ſo to diſpoſe all thoſe Numbers into another like ſquare of Cells, that all the Numbers of each band, whether to the right or to the left, upwards or downwards, or diagonally, the Numbers given being in an* Arithmetical *Progreſſion,* added *together, do always make the ſame* Summe, *and thoſe in a* Geometrical *Progreſſion,* multiplied *into one another, do always make the ſame* Product.

II. SYNOPSIS OPTICA, *Auth.* HONORATO FABRI, *Soc. Jeſu,* Lugduni Gall. *in* 4. *An.* 1667.

This Author pretends to have compriſed in this Treatiſe, containing 58 *Propoſitions*, beſides many *Corollaries*, all what hath been hitherto diſcover'd in *Opticks*, and to have added thereto many curious and uſeful remarks, not mentioned in other Authours.

He begins with that part, which is the moſt ſimple, and conſiders the *Streight* Ray, call'd by the general name of *Opticks*: where he ſhews, what is the cauſe of thoſe ſurprizing effects of the *Perſpective*, which ſo pleaſingly deceive the eye; examining there many curious Experiments.

In the *ſecond* part (the *Catoptricks*, that have for their Object Rays *Reflected*) he gives an Account of all the Apparences in *Looking-glaſſes*, Convex, Concave, Cylindrical, *&c.*

In the *third* (the *Dioptricks*, that conſider Rays *Refracted*) he treats largely of *Teleſcopes* of all ſorts, Spherical, Elliptical, Hyperbolical; as alſo of *Microſcopes*, and the effects of all of them. Where among many other particulars, he delivers and commends, as an invention of *Euſtachio Divini*, the way of furniſhing a *Teleſcope* with two Eye-Glaſſes, outwardly *flat*, and inwardly *convex*, ſo as that they touch one another in the center of their convex ſuperficies.

In this part he explicates the Doctrine of Refractions and Parallaxes; annexing ſeveral Particulars concerning *Comets*, the *Ring of Saturn*, &c. and concluding all with an *Appendix*, wherein having refuted the *Spiral Hypotheſis*, deviſed to ſupport he *Ptolemaick* ſyſteme of the world, he advanceth a new one, judged by him very ſutable to render an account of the Motion of the Celeſtial Bodies in the ſame ſyſteme that ſuppoſeth the Earths immobility, which he ſeems unwilling to deſert.

III. DE VI PERCUSSIONIS, JOH. ALPHONS. BORELLI. Bononiæ in 4. 1667.

Whereas

Whereas in the doctrine of *Percuſſion* ſeveral things are to be accurately diſtinguiſht, as the *Force percuſſive*, the *Motion*, or the *Velocity* of the Percuſſion, and the *Reſiſtance* of the Body percuſſed; and then an Eſtimate to be made of the *Proportion* of thoſe three to one another: This Authour pretends to have both aſſigned that *difference*, and demonſtrated the *Proportion*; Adding, that though *Galilæo* ſaw and acknowledged (*vid.* at the End of his fourth Dialogue *De Motu Projectorum*) That the *Force of Percuſſion was Infinite*, or (rather) *unlimited*, yet he there referr'd diſcourſing upon that Argument to another opportunity; which not having been performed by him (for ought could be found by any of his writings, either Printed or Manuſcript, which latter were purpoſely ſearched after his death to find ſuch a diſcourſe) our Authour pretends, that that Propoſition concerning the *Infiniteneſs of the force of Percuſſion*, not having been yet demonſtrated by any, he hath in this *Book* reſumed the whole matter concerning *Percuſſion*, and clearly demonſtrated the true and genuine Nature of it, its Cauſe, Proprieties and Effects. In the doing of which, he taketh occaſion to diſcourſe alſo of *Gravity*, *Maguetiſme*, *Tremor of Bodies*, *Pendulums*, *&c.* All which, whileſt the *Reader* is conſidering, the Authour tells him, that he is making ready his other Books concerning the *Motions of Animals*.

IV. *NIC. STENONIS MUSCULI DESCRIPTIO GEOMETRICA, Florentiæ in* 4o. *An.* 1667.

The Author of this *Book* declareth, that his deſign in compoſing it was, to ſhew, that in a *Muſcle* neither the *Parts* of it can be diſtinctly named, nor its *Motion* duely conſider'd, unleſs the Doctrine thereof become a part of the *Mathematicks*. And he is of opinion, that there is no other cauſe of the many Errors, which ſpoil the Hiſtory concerning the *Humane Body*, than that *Anatomy* hath hitherto diſdaind the *Laws* of the *Mathematicks*. And therefore inviteth thoſe that are ſtudious in that part of *Philoſophy*, to conſider, that our Body is an *Engine* made up of a thouſand ſubordinate Engins, whoſe true knowledge whoever thinks that it can be inveſtigated without *Mathematical* aſſiſtance, muſt alſo think, that there is matter without *Extenſion*, and Body without *Figure*.

Hereupon he ſhews, that the very *Fabrick* of the *Muſcles* impoſeth a kind of neceſſity upon *conſidering* Writers to explicate them *Mathematically*: In conformity whereunto he pretends to have found, that in every Muſcle there is One *Parallelepiped* of Fleſh, and Two *Tetragonal Priſmes* of Tendons; defining a *Muſcle* to be a Body compoſed of divers ſeries's or ranks of Fibers equal, like, and parallel among themſelves, and ſo immediately placed upon one another, that whole ranks are congruous to whole ranks. Here he explains the *Dimenſions* of a Muſcle, its Contraction, and Strength, and adds that the *Uſe* of this new diſcovery of the ſtructure of the *Muſcles*, is, to demonſtrate, That they *may* ſwell in their Contraction without the Acceſſion of new matter.

He ſubjoyns a Letter to Monſieur *Thevenot*, in which, among other things, he alledges ſeveral Experiments, to ſhew, that the Motion of the *Heart* is like the Motion of *Muſcles*; and anſwers thoſe, who pretend that the true Fabrick of the *Heart* hath already

been

been obſerved heretofore; and thoſe likewiſe, who think that theſe new Obſervations of the Muſcles are uncertain; concluding this Subject with an Enumeration of the particulars, yet remaining to be ſearch'd into, in the *Hiſtory* of the *Muſcles*.

To all theſe things he adds Two Narratives; One of a diſſected Head of a *Sharke* which he calls *Canis Carcharia*; where he delivers many curious Obſervations of the Skin, Eye, optick Nerves, Ocular Muſcles, exceeding ſmalneſs of the Brain, as alſo of the Mouth, and ſtrange Teeth of this Fiſh; examining withal, whether the *Gloſſopetræ* be the *Teeth* of this Creature, or *Stones* produced by the Earth: in which controverſie he takes their part, who maintain that thoſe and divers other ſubſtances, found in the Earth, are parts of the Bodies of Animals, and endeavours to prove, that ſuch ſorts of Earth may be the ſediments of water, and ſuch Bodies, the parts of Animals carried down together with thoſe ſediments, and in progreſs of time reduced to a ſtony hardneſs. *

* *This Subject Mr.* Hook *hath alſo diſcourſed of at large in ſeveral of his publick Lectures, founded by Sir* John Cutler; *which Lectures he read about Two years ſince in* Greſham Colledge, *in the preſence of many Learned and Curious perſons; which alſo had been long ſince made publick, had not other indiſpenſable affairs hindred him from taking care of the Preſs: where he hath not only ſhewn the Origin of theſe* Gloſſopetræ, *but of all other curiouſly figur'd Stones and Minerals, together with that of Mountains, Lakes, Iſlands,* &c. *though from a ſomewhat dif fering* Hypotheſis, *of which the curious may ſhortly receive a further Account.*

The *other* Narrative is of a Female *Dog-Fiſh*, diſſected alſo by himſelf, where do occur no leſs remarkable obſervations, than in the former, both of the parts in the Head, and of thoſe in the Body; as touching the ſmall weight of the Brain of this Fiſh, compared to the weight of its Body; ſeveral *little Fiſhes* found in the Stomach, untouched by any Teeth; the *Ureters*, the *Ovarium*, and *Oviductus*, where he digreſſes, to ſhew, *Mulierum teſtes eſſe Ovario analogos*, and refers, for further proof of this to his intended Treatiſe, which is to give an account *de partium Genitalium Analogia*.

An Advertiſement.

The *Publiſher* hereof gives notice, that a Brief *Index* for the *Tranſactions* of this laſt year, beginning at *Numb.* 23. in *March* 1667. ſhall be Printed a part, for the uſe of ſuch as deſire to have all thoſe *Numbers* together.

ERRATA.

WHat the Printer for want of room, did omit hitherto in the giving notice of an Error *committed by him in* Numb. 29. *the Reader is now deſired to obſerve here,* viz. *That in the ſaid* Numb. *for want of Marks proper to expreſs* Multiplication, *there was uſed* pag. 571. l. 5.7. *the mark of* plus *or* addition; *which yet 'tis thought could hardly occaſion any miſtake in the Intelligent Readers, who might eaſily ſee the meaning of the Author by the* lines 8. 9. 10. *of the next precedent page* 570.

In the *SAVOY*,

Printed by *T. N.* for *John Martyn*, Printer to the *Royal Society*, and are to be ſold at the *Bell* a little without *Temple-Bar*, 1667.

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